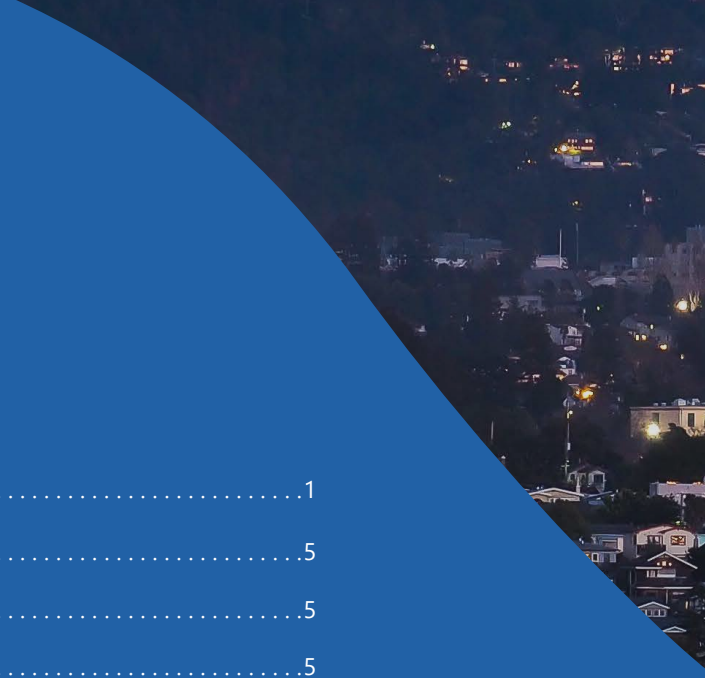
Local Roadway Safety Plan

Final Report

March 2023



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GLOSSARY

4 E's – Abbreviation for Education, Enforcement, Engineering, Emergency Medical Services: A traffic engineering approach for improving safety on the roadways.

ACS – Abbreviation for American Community Survey: A U.S. Census survey that helps local officials, community leaders, and businesses understand the changes taking place in their communities.

ADT – Abbreviation for average daily traffic: Refers to vehicle traffic volumes.

BCR – Abbreviation for benefit-cost ratio: Indicator used to quantify project benefits in relation to project costs.

LRSP – Abbreviation for local road safety plan. A document that provides a framework for identifying, analyzing, and prioritizing roadway safety improvements on local roads.

CRF – Abbreviation for crash reduction factor: The percentage of expected effect of a countermeasure or safety project to decrease collisions.

Collision Severity – Defined as the intensity of collisions typically in the following categories: fatal (F), severe injury (SI), other visible injury and complaint of pain (Other), and property damage only (PDO).

EMS – Abbreviation emergency medical services.

EPDO – Abbreviation for equivalent property damage only.

FHWA – Abbreviation for Federal Highway Administration: The federal agency responsible managing the nation's highway system, including bridges and tunnels.

HSIP – Abbreviation for Highway Safety Improvement Program: A roadway safety funding program managed by Caltrans, California State Department of Transportation.

KSI – Abbreviation for killed and severe injury collisions.

LRSM – Abbreviation for Local Roadway Safety Manual: A Manual for California's Local Road Owners.

Primary Violation Factor/Primary Collision Factor – Defined as contributing causes of collisions.

SWITRS - Abbreviation for Statewide Integrated Traffic Records System: A database managed by California Highway Patrol that collects and processes data gathered from collision scenes.

TIMS - Abbreviation for Transportation Injury Mapping System: A collision database managed by UC Berkeley SafeTREC system.

EXECUTIVE SUMMARY

The City of Albany's Local Road Safety Plan (LRSP) is a comprehensive plan that creates a framework to systematically identify and analyze traffic safety related issues and recommend projects and countermeasures. It aims to reduce killed and severe injury (KSI) collisions through a prioritized list of improvements that can enhance safety on local roadways.

The LRSP takes a proactive approach to addressing safety needs. It is viewed as a guidance document that can be a source of information and ideas. It will also be a living document, one that is routinely reviewed and updated by City staff and their safety partners to reflect evolving collision trends and community needs and priorities. With the LRSP as a guide, the City will be able to apply for grant funds, such as the federal Highway Safety Improvement Program (HSIP) or One Bay Area Grant (OBAG). This document summarizes an analysis of collisions that occurred in Albany, identifies high-injury locations, and recommends countermeasures at each of these high-risk locations. It is organized into eight sections as follows:

CHAPTER 1 – INTRODUCTION

The Introduction describes what an LRSP is and details the study area.

CHAPTER 2 – SAFETY PARTNERS

Involvement of safety partners is critical in the success of the LRSP. For the City of Albany, this included City Staff, Albany Police Department, Albany Fire Department, Albany Unified School District, AC Transit, Alameda County Transportation Commission, Caltrans, and Albany residents. This chapter summarizes the involvement of the stakeholders in the LRSP process.

CHAPTER 3 – EXISTING PLANNING EFFORTS

This chapter summarizes City and regional planning documents and projects that are relevant to the LRSP. It ensures that the recommendations of the LRSP are in line with existing goals, objectives, policies, or projects.

CHAPTER 4 – COLLISION DATA AND ANALYSIS

This chapter summarizes the data analysis approach and presents preliminary as well as detailed collision analysis and findings in the study area. This analysis of KSI collisions is performed by facility type (intersection and roadway segment). Collision data was obtained and analyzed for a five-year period from 2016-2020 from the California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS) and the University of California at Berkeley SafeTREC's Transportation Injury Mapping Service (TIMS). This time period was chosen because 2021 data were preliminary at the time of the analysis. It should be noted that in many situations for prior collisions, the safety measures are implemented post collision that may result in eliminating or reducing future collisions. For post 2020 collisions, future reviews and updates of the LRSP will capture those collisions.

CHAPTER 5 – EMPHASIS AREAS

Emphasis areas are a focus of the LRSP that are identified through the various collision types and factors resulting in fatal and severe injury collisions within the City of Albany. The seven emphasis areas for Albany are:

- Improve Safety at Unsignalized Intersections (Collisions within 250 feet of an intersection)
- Address Broadside Collisions and Automobile Right of Way Violations
- Address Rear End Collisions
- Address Improper Turning Collisions
- Address Bicycle Safety
- Address Pedestrian Safety
- Improve San Pablo Ave (Intersection and Roadway Segment)

CHAPTER 6 – COUNTERMEASURE IDENTIFICATION

Engineering countermeasures were selected for each of the high-risk locations and for the emphasis areas. These were based off of approved countermeasures from the Caltrans Local Roadway Safety Manual (LRSM) used in HSIP grant calls for projects. The intention is to give the City potential countermeasures for each location that can be implemented either in future HSIP calls for projects, or using other funding sources, such as the City's Capital Improvement Program. Non-engineering countermeasures were also selected using the 5 E's strategies, and are included with the emphasis areas.

CHAPTER 7 – SAFETY PROJECTS

A set of nine safety projects were created for high-risk intersections and roadway segments, using HSIP approved countermeasures. These safety projects are:

- Project #1: Systemic Improvements at Signalized Intersections (Improve signal timings, Install raised pavement markers and striping)
- Project #2: Systemic Improvements at Signalized Intersections (Pedestrian and Bicycle) (Improve signal hardware, Install advance stop bar before crosswalk, Modify signal phasing to implement a Leading Pedestrian Interval [LPI])
- Project #3: Systemic Improvements at Un-signalized Intersections(Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs, Install flashing beacons at stop-controlled intersections, Install splitter-island on the minor road approaches, Install raised medians on approaches)
- Project #4: Systemic Improvements at Un-signalized Intersections (Pedestrian Safety) (Install/upgrade pedestrian crossing at uncontrolled location, Install rectangular rapid flashing beacons [RRFB])
- Project #5: Citywide Signal Upgrade
- Project #6: Citywide Street Light Inventory
- Project #7: Citywide Leading Pedestrian Inventory (LPI) feasibility
- Project #8: Systemic Improvements at Roadway Segments (Install median barrier, Install/upgrade signs with new fluorescent sheeting, install delineators, reflectors and/ object markers, Install edge-line and centerlines, Install centerline rumble strips/stripes, Install edge-line rumble strip/stripes)
- Project #9: System Improvements at Roadway Segments (Pedestrian and Bicycle Safety) (Install separated bike lanes, Install raised pedestrian crossing, Install rectangular flashing beacons)

CHAPTER 8 – IMPLEMENTATION AND EVALUATION

The LRSP is a guidance document that is recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and emergency medical service-related countermeasures that can be implemented throughout the City to reduce fatal and severe injury collisions. After implementing countermeasures, the performance measures for each emphasis area should be evaluated annually. The most important measure of success of the LRSP should be reducing fatal and severe injury collisions throughout the City. If the number of fatal and severe injury collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

1 | INTRODUCTION

1 INTRODUCTION

What is an LRSP?

The Local Road Safety Plan (LRSP) is a localized data-driven traffic safety plan that provides opportunities to address unique roadway safety needs and reduce the number of KSI collisions. The LRSP creates a framework to systematically identify and analyze traffic safety-related issues, and recommend safety projects and countermeasures. It facilitates the development of local agency partnerships and collaboration, resulting in the development of a prioritized list of improvements that can qualify for HSIP funding. The LRSP is a proactive approach to addressing safety needs and is viewed as a living document that can be constantly reviewed and revised to reflect evolving trends, and community needs and priorities.

PROCESS

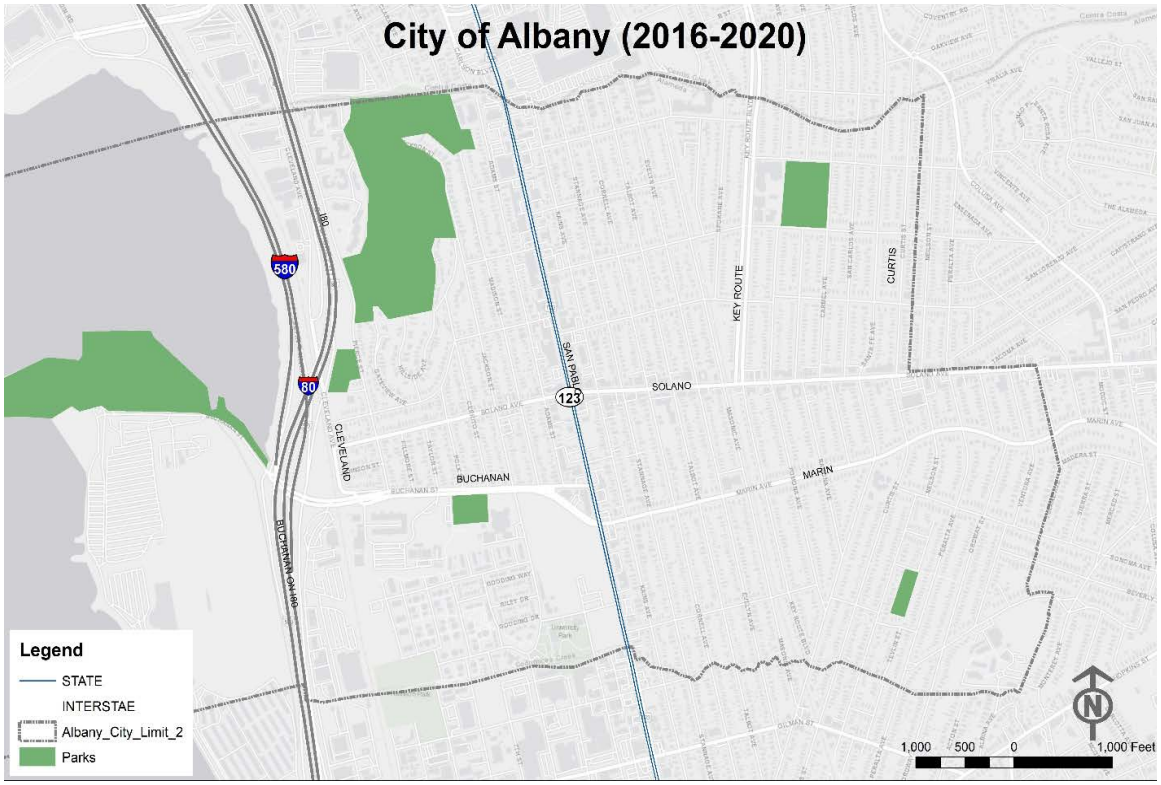
The systemic approach in preparing the LRSP involves the following steps:

- Develop plan goals and objectives
- Analyze collision data
- Meet with stakeholders/safety partners
- Determine focus areas and identify crash reduction strategies
- Prioritize countermeasures/projects
- Prepare the LRSP

Study Area

The City of Albany, located in Alameda County, California, covers a total area of 5.5 square miles, of which 1.8 square miles is land and 3.7 square miles water. City of Albany is located on the east shore of San Francisco Bay in northwestern Alameda County. The City's estimated population is 19,488 (US Census 2021). San Pablo Avenue, Solano Avenue, Buchanan St and Marin St are main thoroughfares that connect the City with nearby cities and Interstate 580. The nearest cities include Berkeley to the east and south, Kensington to the northeast, El Cerrito to the north and Richmond to Northwest. The study area is mapped in **Figure 1** on the following page.

Figure 1. Study Area



According to five-year estimates from the American Community Survey (ACS) 2020 from the U.S. Census, 36% of Albany commuters get to work by driving alone, lower than both the Alameda County and State rate of driving commuters. The second most common method of commuting to work is public transportation at 25.8%. The different modes of transportation used by Albany residents to commute to work are shown in Table 1 below.

Table 1. Albany Commute to Work Census Data

Commute to Work	Albany	Alameda County	California
Drive Alone	36%	58.5%	75.9%
Carpool	7.97%	9.5%	14.5%
Public Transportation	25.8%	14.3%	5.1%
Walked	5.08%	3.3%	2.9%
Bicycle	6%	1.6%	0.8%
Work from Home	17.3%	11%	3.8%
Other	0.9%	1.05%	0.8%

Source: Data from the Census Bureau ACS 5-year Estimate 2020

2 | SAFETY PARTNERS

2 SAFETY PARTNERS

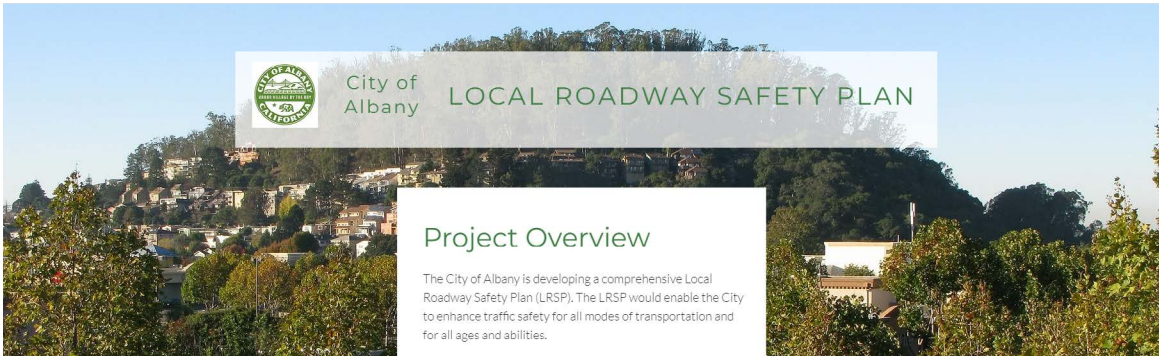
Safety partners are vital to the development and implementation of an LRSP. For the City of Albany, these include City Staff, Albany Police Department, Albany Fire Department, Albany Unified School District, AC Transit, Alameda County Transportation Commission, Caltrans, and Albany residents. These stakeholders attended one virtual stakeholder meetings held on May 25, 2022 to review project goals and findings and to solicit feedback from the group.

In addition, four presentations were given to the Transportation Commission to review projects goals and findings, review website feedback, review countermeasures and safety projects, and provide feedback and comments. These virtual meetings were held on March 24, 2022, June 23, 2022, July 27, 2022, and October 27, 2022.

Figure 2. Zoom Meeting from Stakeholder Meeting #1

This stakeholder outreach was supplemented by a project website with an interactive platform. The interactive map was used to solicit from City of Albany residents and stakeholder outside the confines of traditional meetings.

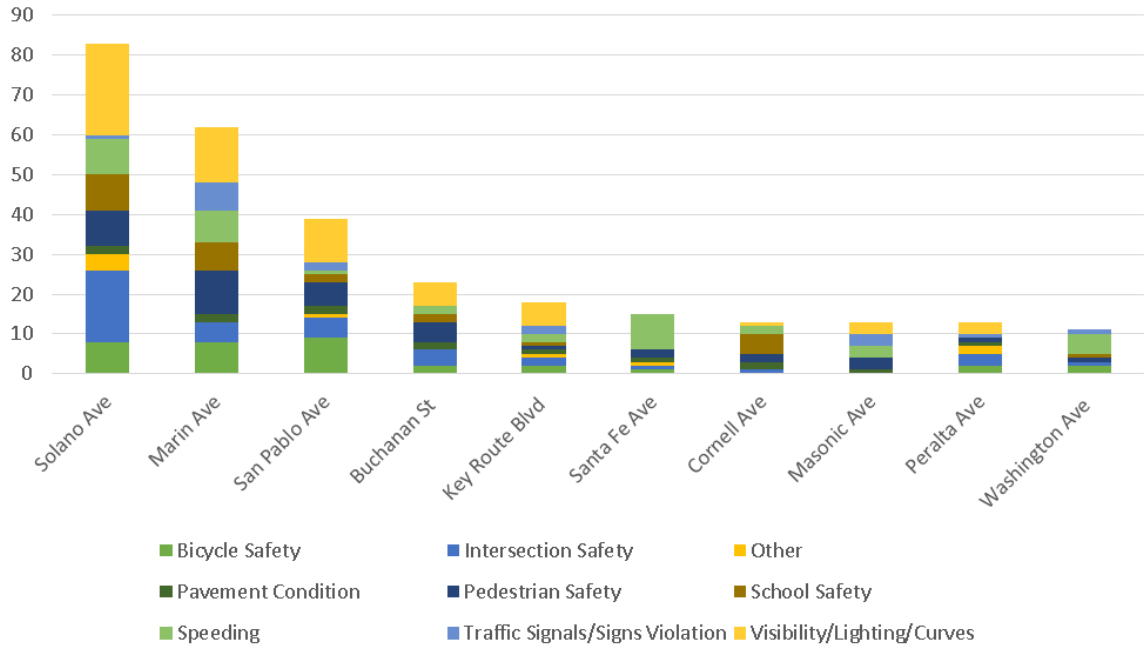
Figure 3. Albany LRSP Project Website



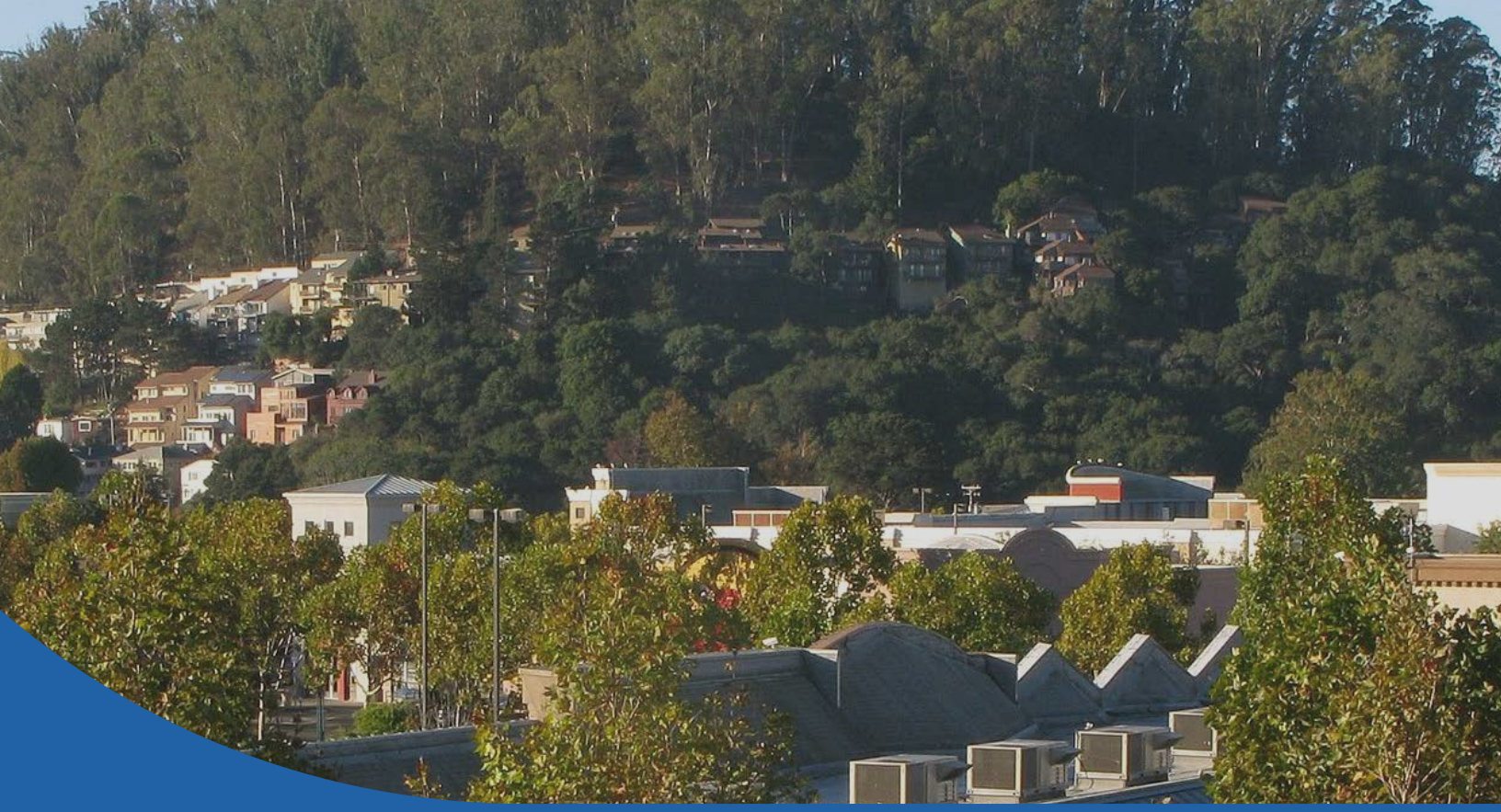
In total, 579 comments were received through the project website for Albany. The most comments were received about Solano Avenue, Marin Avenue, and San Pablo Avenue, and the most common concerns were visibility, lighting, curves, speeding, and bicycle and pedestrian safety. The results of the interactive map are shown below in **Figure 4**, and summarized in **Figure 5**. In **Figure 4**, each dot and line represents a comment provided by a community member.

Figure 4. Interactive Map Comment Responses

Figure 5. Public Comments on Traffic Safety by Location



Note: Corridors with less than two comments are not listed in this summary. Category was chosen based on the primary issue listed in the comment. Each comment was assigned to the major road if at an intersection.



3 | EXISTING PLANNING EFFORTS

3 EXISTING PLANNING EFFORTS

This chapter summarizes the planning documents, projects underway, and studies reviewed for the City of Albany LRSP. The purpose of this chapter is to ensure the LRSP vision, goals, and 5 E's strategies (**E**ducation, **E**nforcement, **E**ngineering, **E**quity, and **E**mergency Medical Services (EMS)) are aligned with prior planning efforts, planned transportation projects, and non-infrastructure programs for the City. The documents reviewed are listed below:

- Albany General Plan | Transportation Element (2035)
- Albany Active Transportation Plan (2019)
- Solana Avenue Complete Streets and Corridor Revitalization Plan (2019)
- City of Albany Engineering and Traffic Survey (2021)
- Albany Traffic Management Plan
- Alameda Countywide Transportation Plan (2020)
- City of Albany Climate Action and Adaptation Plan (2019)

The following sections include brief descriptions of these documents and how they inform the development of the LRSP. A detailed list of relevant policies and projects is listed in **Appendix A.**

ALBANY GENERAL PLAN | TRANSPORTATION ELEMENT (2035)

The General Plan mobility element identifies safe, reliable and accessible transportation needs within Albany and seeks to maintain and improve the city's transportation network through policies and standards. The General Plan also reflects goals to create better and safer communities through a multi-modal circulation system, complete streets, transportation options, integrating land use and transportation, mobility and neighborhood quality, and regional leadership. The element is organized into five parts, detailing the existing conditions of the system and projecting future conditions and needs. These goals and policies inform City's LRSP to improve roadway safety for all so that it encourages users to choose walking, bicycling, and transit as a mode of transportation in Albany to reduce traffic trips and improve environmental quality.

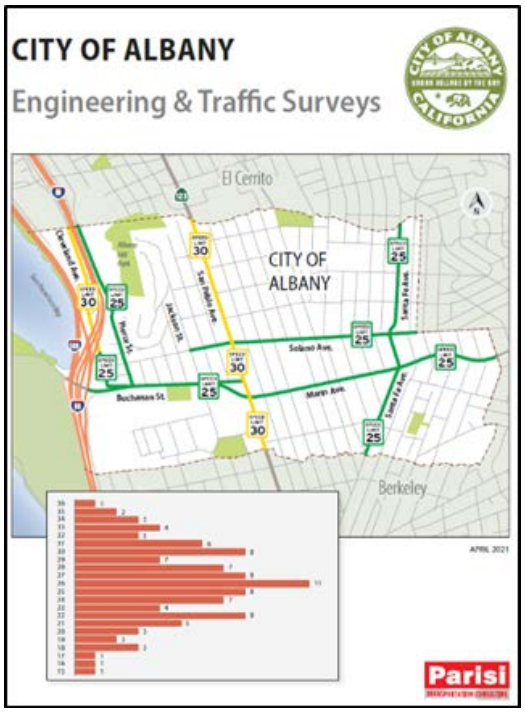
ALBANY ACTIVE TRANSPORTATION PLAN (2019)

The Albany Active Transportation Plan is a combination of the previous Bicycle Master Plan and Pedestrian Master Plan and assesses unmet needs for non-motorized transportation in the city. The plan sets forth key goals and policy objectives that apply to walking and bicycling facilities directly and seeks to institutionalize the accomodation for these modes throughout City policies and practices. It also recommends developing city wide bicycle routes, safe routes to school, traffic calming strategies, expanding the network of off-street path, and identify priorty safety improvements. It does this by proposing a system of bikeways and pedestrian facilities that connect neighborhoods to key activity centers throughout the City; developing essential support facilities, such as bike parking; suggesting education, encouragement and other programs; and identifying recommendations for improving safety for walkers and cyclists. The Plan prioritizes routes to schools, BART, Solano Avenue, San Pablo Avenue, shopping, parks, the waterfront, and neighboring Cities.

SOLANO AVENUE COMPLETE STREETS AND CORRIDOR REVILATIZATION PLAN (2019)

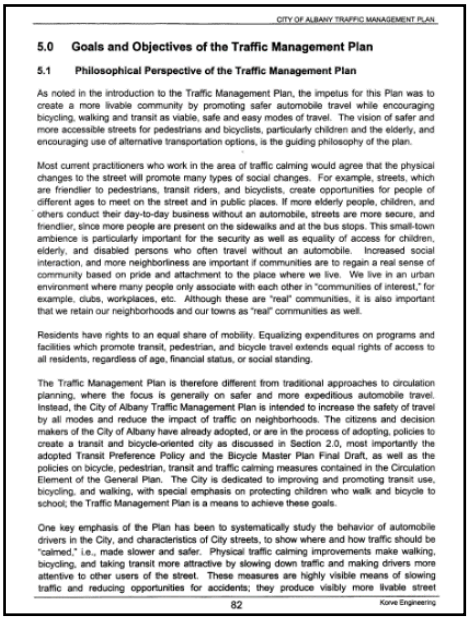
The Solano Avenue Complete Streets and Corridor Revitalization Plan provides a vision for the future of Solano Avenue from Masonic Avenue to Tulare Avenue, and presents a proposed corridor design, design palette and supportive strategies. The Plan proposes streetscape and mobility improvements to improve safety, enhance access, deliver a cohesive streetscape and support economic development. This Plan envisions modifying the existing corridor to better serve pedestrians, bicyclists, motorists, and transit riders. This Plan incorporates innovative urban design and infrastructure upgrades to improve pedestrian safety and access, provide stronger connections to transit, enhance the public realm, implement spot improvements for bicyclists, manage curbside space, and improve predictability for motorists. The goal is a vibrant and accessible main street for Albany that is safe, comfortable, and enjoyable for all users whether they arrive by foot, by bike, in a wheelchair, on public transit, or in a car.

CITY OF ALBANY ENGINEERING AND TRAFFIC SURVEYS (2021)



Engineering and Traffic Surveys were conducted for the City of Albany along eight bi-directional roadway segments within the City limits. The survey was conducted in compliance with regulations set in the California Vehicle Code and was based on the guidelines for setting proper speed limits established by the California Department of Transportation (Caltrans) as documented in the California Manual for Setting Speed Limits (2014). The report also includes the measurements of the free-flowing speeds along with the survey segments, and also includes collision analysis and existing roadside conditions or future improvements. The report establishes guidelines for setting a speed limit that provides a rational and defensible determination using the Engineering and Traffic Surveys. The report also identifies locations for speed zones and effects on traffic signals and stop signs on vehicle travel speeds.

ALBANY TRAFFIC MANAGEMENT PLAN



CITY OF ALBANY TRAFFIC MANAGEMENT PLAN

5.0 Goals and Objectives of the Traffic Management Plan

5.1 Philosophical Perspective of the Traffic Management Plan

As noted in the introduction to the Traffic Management Plan, the impetus for this Plan was to create a more livable community by promoting safer automobile travel while encouraging bicycling, walking and transit as viable, safe and easy modes of travel. The vision of safer and more accessible streets for pedestrians and bicyclists, particularly children and the elderly, and encouraging use of alternative transportation options, is the guiding philosophy of the plan.

Most current practitioners who work in the area of traffic calming would agree that the physical changes to the street will promote many types of social changes. For example, streets, which are friendlier to pedestrians, transit riders, and bicyclists, create opportunities for people of different ages to meet on the street and in public places. If more elderly people, children, and others conduct their day-to-day business without an automobile, streets are more secure, and friendlier, since more people are present on the sidewalks and at the bus stops. This small-town ambience is particularly important for the security as well as equality of access for children, elderly, and disabled persons who often travel without an automobile. Increased social interaction, and more neighborliness are important if communities are to regain a real sense of community based on pride and attachment to the place where we live. We live in an urban environment where many people only associate with each other in "communities of interest," for example, clubs, workplaces, etc. Although these are "real" communities, it is also important that we retain our neighborhoods and our towns as "real" communities as well.

Residents have rights to an equal share of mobility. Equalizing expenditures on programs and facilities which promote transit, pedestrian, and bicycle travel extends equal rights of access to all residents, regardless of age, financial status, or social standing.

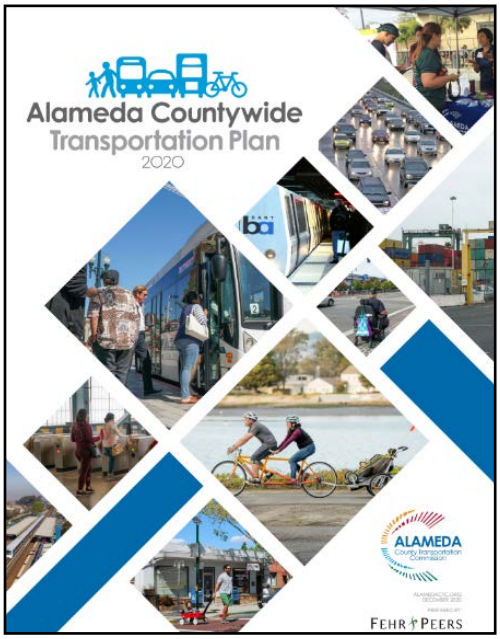
The Traffic Management Plan is therefore different from traditional approaches to circulation planning, where the focus is generally on safer and more expeditious automobile travel. Instead, the City of Albany Traffic Management Plan is intended to increase the safety of travel by all modes and reduce the impact of traffic on neighborhoods. The citizens and decision makers of the City of Albany have already adopted, or are in the process of adopting, policies to create a transit and bicycle-oriented city as discussed in Section 2.0, most importantly the adopted Transit Preference Policy and the Bicycle Master Plan Final Draft, as well as the policies on bicycle, pedestrian, transit and traffic calming measures contained in the Circulation Element of the General Plan. The City is dedicated to improving and promoting transit use, bicycling, and walking, with special emphasis on protecting children who walk and bicycle to school; the Traffic Management Plan is a means to achieve these goals.

One key emphasis of the Plan has been to systematically study the behavior of automobile drivers in the City, and characteristics of City streets, to show where and how traffic should be "calmed," i.e., made slower and safer. Physical traffic calming improvements make walking, bicycling, and taking transit more attractive by slowing down traffic and making drivers more attentive to other users of the street. These measures are highly visible means of slowing traffic and reducing opportunities for accidents; they produce visibly more livable street

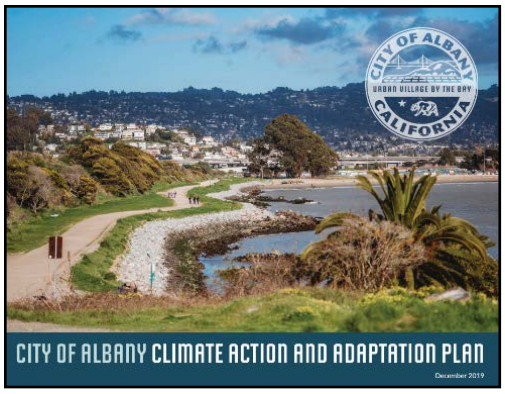
82 Korve Engineering

The purpose of the Albany Traffic Management Plan is to create a more livable community by promoting safer automobile travel while encouraging bicycling, walking, and transit as viable, safe, and easy modes of travel. The vision of safer and more accessible streets for pedestrians and bicyclists, particularly children and older adults, and encouraging use of alternative transportation options, is the guiding philosophy of the plan. It provides a toolbox by which City staff and residents can implement traffic calming strategies within Albany, as well as facilitate transit access and mitigate truck traffic.

ALAMEDA COUNTYWIDE TRANSPORTATION PLAN (2020)



This countywide plan prepared by the Alameda County Transportation Commission, sets a vision for the future of the transportation system in Alameda County. It was developed in order to assess the current state of the transportation, project future needs, and prioritize improvements. The goals included in the plan are expanding multimodal connectivity, reducing greenhouse gas emissions, maximize modern infrastructure benefits and intergrating sustainable transit-oriented development for regional and interregional travel. The plan includes an assessment of the needs and priorities for each transportation mode in the county. It also emphasizes on making transportation improvements in key locations, such as low- income communities, communities of color, and areas prioritized for growth and development (specifically in Priority Development Areas). The plan includes various strategies identifying opportunities beyond building infrastructure and delivering transportation services to advance the vison and goals and address needs.



CITY OF ALBANY CLIMATE ACTION AND ADAPTATION PLAN (2019)

This citywide plan, as part of the Albany City Council's Strategic Vision, was adopted to ensure long-term sustainability and resilience from climate change and its effects. This plan builds on the success of the City's first Climate Action Plan (CAP) and sets new targets including a 70% reduction in greenhouse gas emissions by 2035, carbon neutrality by 2045, and smart, equitable resilience investments. Promotion of active transportation and a 25% reduction of miles traveled in passenger vehicles are two of the action points for the overall plan.

4 | COLLISION DATA AND ANALYSIS

4 COLLISION DATA AND ANALYSIS

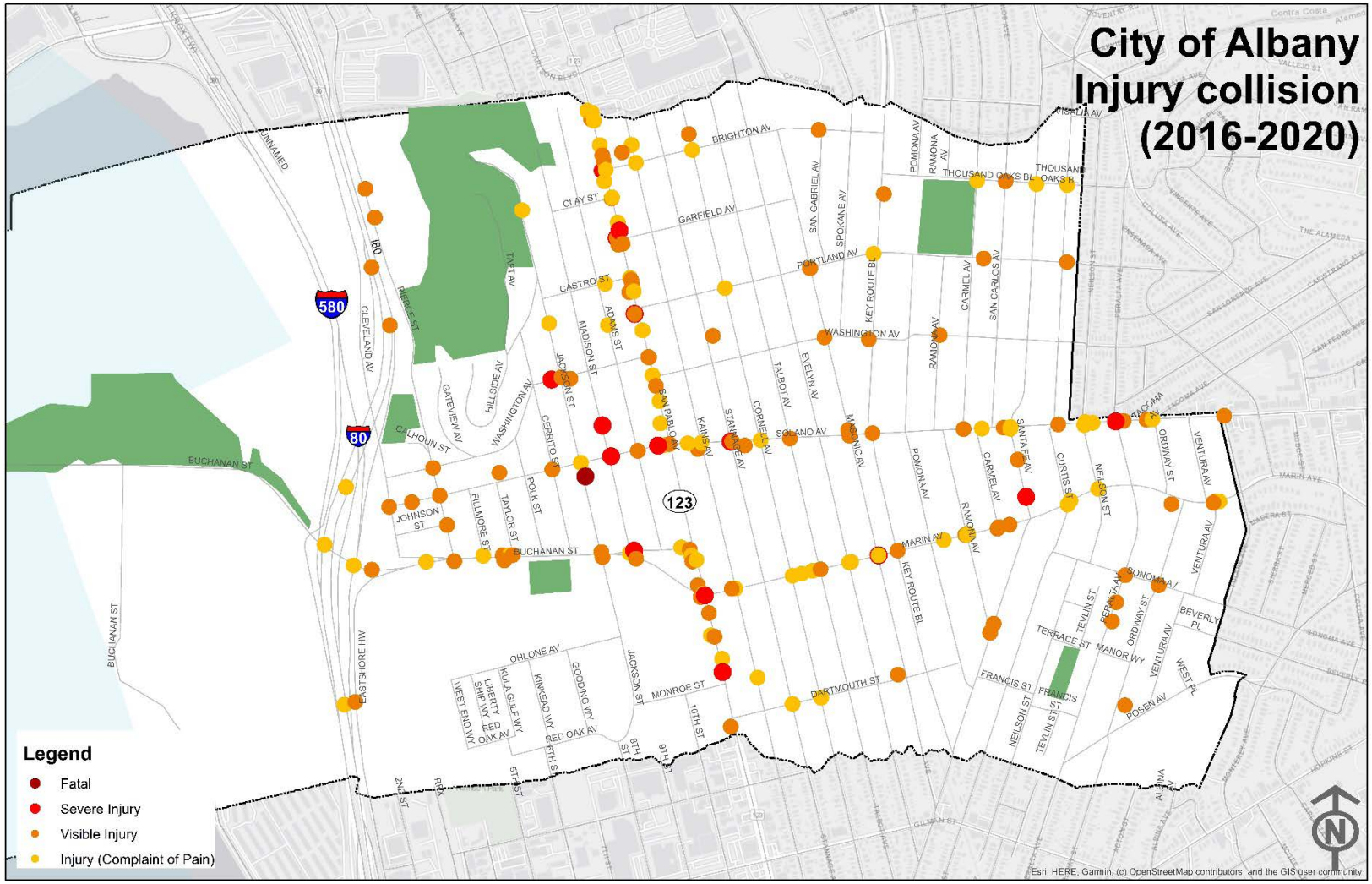
This chapter summarizes the results of the analysis of collisions that have occurred in the City of Albany between January 2016 and December 2020, as part of the LRSP. This chapter includes the following sections:

- Data Collection
- Collision Data Analysis
- KSI Collision Analysis
- Geographic Collision Analysis
- High Injury Network
- Bicycle and Pedestrian High Injury Network
- Summary

The LRSP focuses on systemically identifying and analyzing traffic safety issues and recommends appropriate safety improvements. The chapter starts with a comprehensive analysis of collisions of all severity in the City of Albany, including Property Damage Only (PDO) collisions, and compares these with KSI collisions. Factors such as collision severity, type of collision, primary collision factor, lighting, weather and time of the day were analyzed. Following this, a more detailed analysis was conducted for KSI collisions that have occurred on the City's roadways, including analyzing intersection and roadway segment collisions separately.

Figure 6 illustrates all the injury collisions that have occurred in the City of Albany from January 1, 2016 to December 31, 2020.

Figure 6. Injury Collisions in the City of Albany (2016-2020)



Data Collection

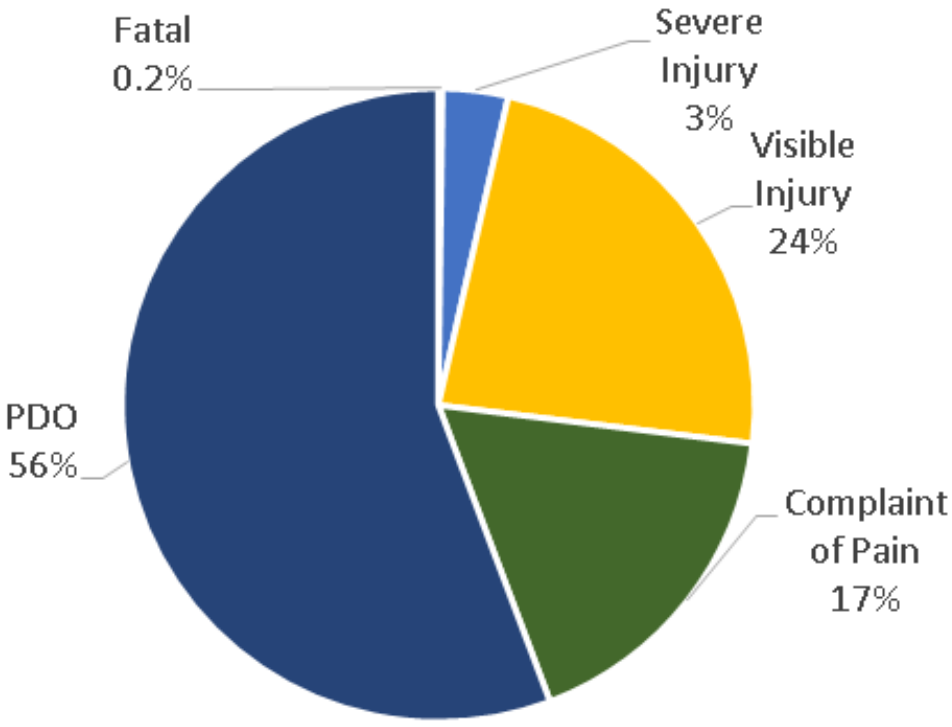
Collision data helps to understand different factors that might be leading to collisions and influencing collision patterns in a given area. For the purpose of this analysis, five-years of jurisdiction-wide collision data (2016 to 2020) was retrieved from Transportation Injury Mapping System (TIMS) and SWITRS. Collisions that occurred on state routes were excluded for this analysis, with the exception of San Pablo Avenue (SR 123). The collision data was analyzed and plotted in ArcMap to identify high-injury intersections and roadway segments.

Collision Data Analysis Results

COLLISION CLASSIFICATION

There were a total of 478 collisions reported on Albany roads from 2016 to 2020. Out of these, 267 collisions (56%) were PDO, 83 collisions (17%) led to complaint of pain injury, 112 collisions (24%) led to a visible injury and 16 collisions led to KSI collisions, of which 15 collisions (3%) led to a severe injury and one collision (0.2%) led to a fatality. **Figure 7** illustrates the classification of all collisions based on severity.

Figure 7. Collisions by Severity (2016-2020)



The analysis first includes a comparative evaluation between all collisions and KSI collisions, based on various factors including (but not limited to): collision trend, primary collision factor, collision type, facility type, motor vehicle involved with, weather, lighting, and time of the day. Following this, a comprehensive analysis is conducted for only KSI collisions. KSI collisions cause the most damage to those affected and to infrastructure. The LRSP process thus focuses on these collision locations to proactively identify and counter safety issues leading to these KSI collisions.

The collision data was separated by facility type, i.e. based on collisions occurring on intersections and roadway segments. In accordance with HSIP guidelines, a collision was designated to have occurred at an intersection if it occurred within 250 feet, as intersections can often influence collisions that occur within this distance. For the purposes of the collision trend analysis, intersection collisions occurred at 250 feet or less from the intersection. Later in this report, the high injury network for intersections is identified with all collisions within 250 feet of an intersection, while roadway segments are identified using all collisions except those that occurred directly at (0 feet) from intersection. This is done to streamline the HSIP application process following the LRSP.

The reported collisions categorized by facility type and collision severity are presented in **Table 2**.

Table 2. Collisions by Severity and Facility Type

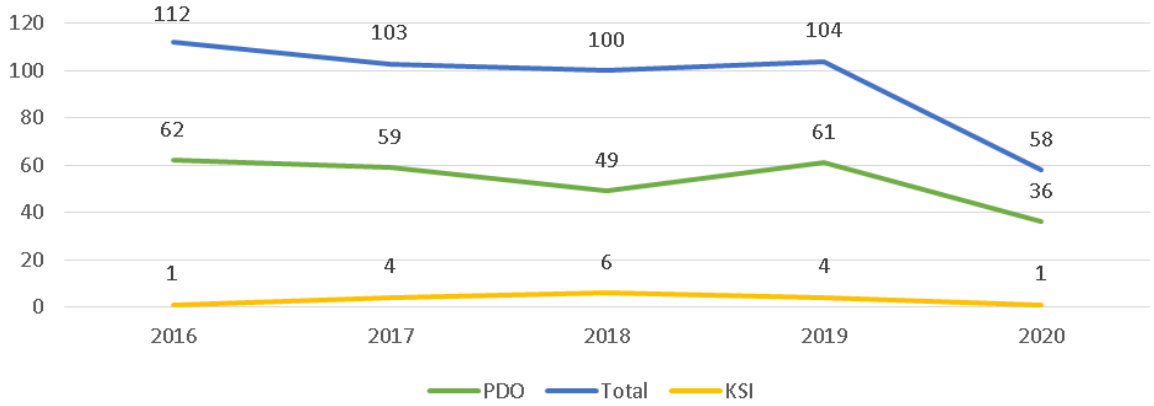
Collision Severity	Roadway Segment	Intersection	Total
Killed	0	1	1
Severe Injury	2	13	15
Visible Injury	4	108	112
Complaint of Pain	1	82	83
PDO	10	257	267
Total	17	462	478

Preliminary Analysis

YEARLY TREND

The number of reported collisions of all severity has overall decreased from 2016 to 2020. The year with the highest number of collisions was 2016 (112 collisions), while the year with the lowest number of collisions were 2020 (58 collisions). A total of 16 KSI collisions occurred in Albany during the study period, overall increasing from 2016 to 2018, then decreasing in 2019 and 2020. The least number of KSI collisions occurred in 2020 (one collision), while the most occurred in 2018 (six collisions). It should be noted that stay-at-home orders due to the COVID-19 pandemic led to decreased traffic volumes, and is the likely contributing factor to a decrease in collisions in 2020. **Figure 8** illustrates the five-year collision trend for all collisions, PDO collisions, and KSI collisions.

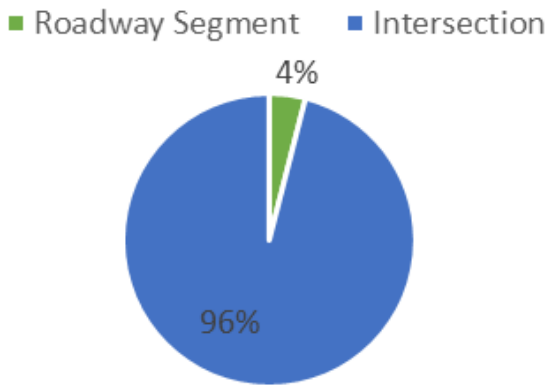
Figure 8. Five Year Collision Trend



ROADWAY SEGMENT VS. INTERSECTION

When evaluating the locations of collisions, the majority of collisions occurred at intersections. In the City of Albany, 96% of all collisions (461 collisions) occurred at intersections whereas 4% (17 collisions) occurred on roadway segments. This classification by facility type can be observed in **Figure 9.**

Figure 9. Intersection vs Roadway Collisions – All Collisions

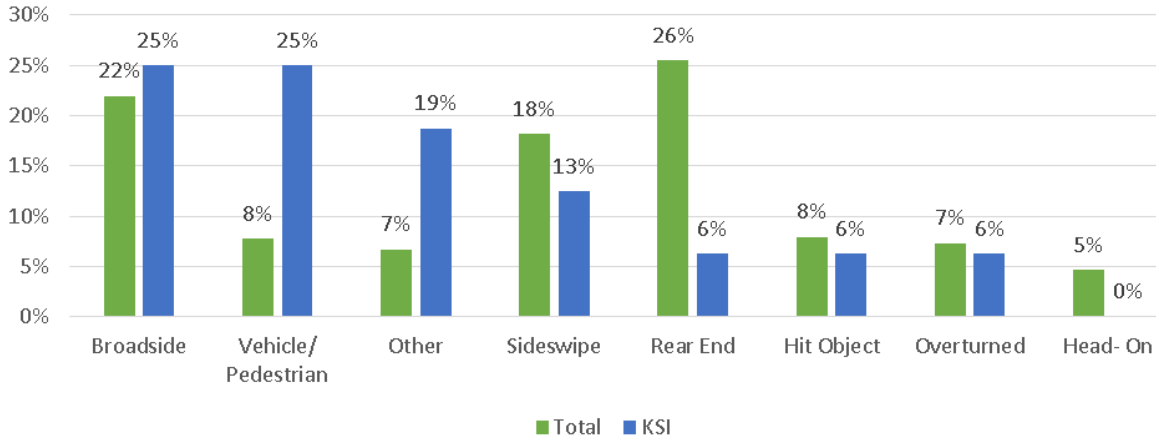


COLLISION TYPE

The most commonly occurring collision types among all collisions were rear end collisions (26%) and broadside collisions (22%). The collision types for KSI collisions follow a slightly different pattern, where the most commonly occurring collision type was broadside and vehicle/pedestrian collisions each (25%), followed by sideswipe collisions (13%). **Figure 10** illustrates the collision type for all collisions as well as KSI collisions. Examples of each collision type:

- Broadside: right angle crashes; front of vehicle collides with the side of another vehicle or bicyclist
- Vehicle/Pedestrian: Vehicle collides with a pedestrian
- Other: Specific collision type was not coded into the police report
- Sideswipe: Two vehicles (or with a bicyclist) collide side-by-side
- Rear End: Front of vehicle collides with the rear of another vehicle
- Hit Object: Vehicle typically leaves road and collides with a fixed object, such as a tree or power pole
- Overturned: Vehicle overturns in the collision
- Head-On: Front of vehicle collides with the front of another vehicle or bicyclist

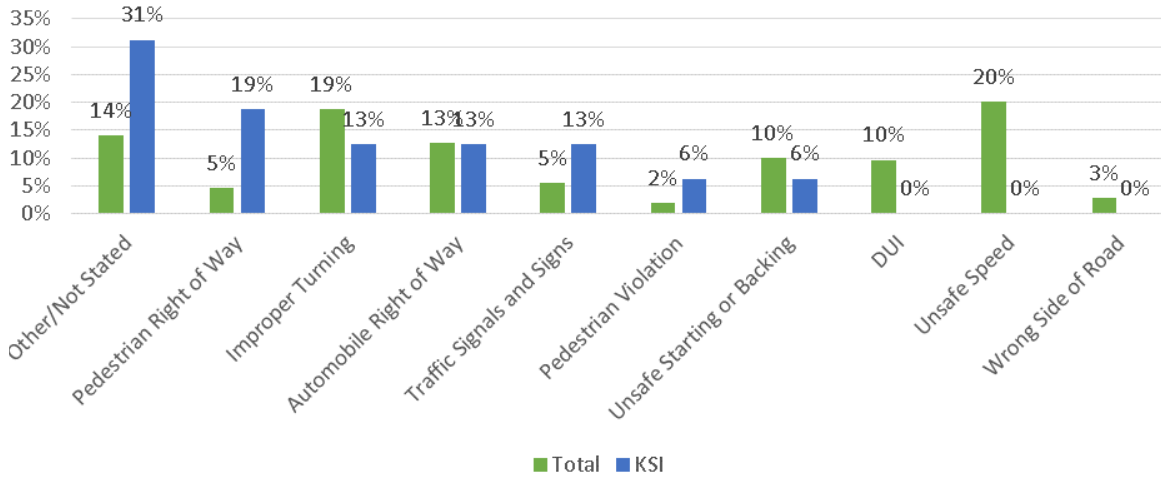
Figure 10. Collision Type – All Collisions vs. KSI Collisions



PRIMARY COLLISION FACTOR

For collisions of all severity, the most common violation category was observed to be unsafe speed (20%), followed by improper turning violations (19%). The most common primary violation categories for KSI collisions (besides Other/Not Stated) was pedestrian right of way violations (19%), followed by improper turning, automobile right of way, and traffic signals and signs, each constituting 13% of KSI collisions. **Figure 11** illustrates this distribution.

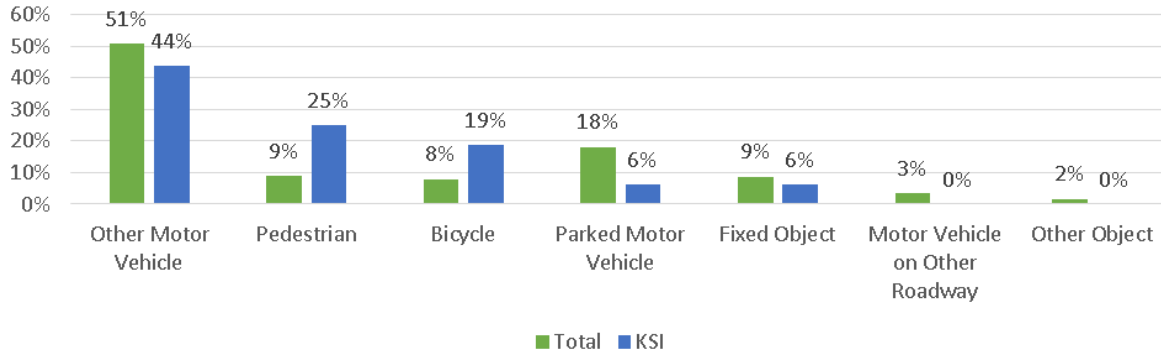
Figure 11. Violation Categories: All Collisions vs. KSI Collisions



MOTOR VEHICLE INVOLVED WITH

For collisions of all severity, 51% of the collisions occurred with other motor vehicles, followed by parked motor vehicle collisions (18%). For KSI collisions, 44% of the collisions occurred with other motor vehicles. This was followed by pedestrian collisions (25%), and bicycle collisions (19%). **Figure 12** illustrates the motor vehicle involved with category for all collisions as well as KSI collisions.

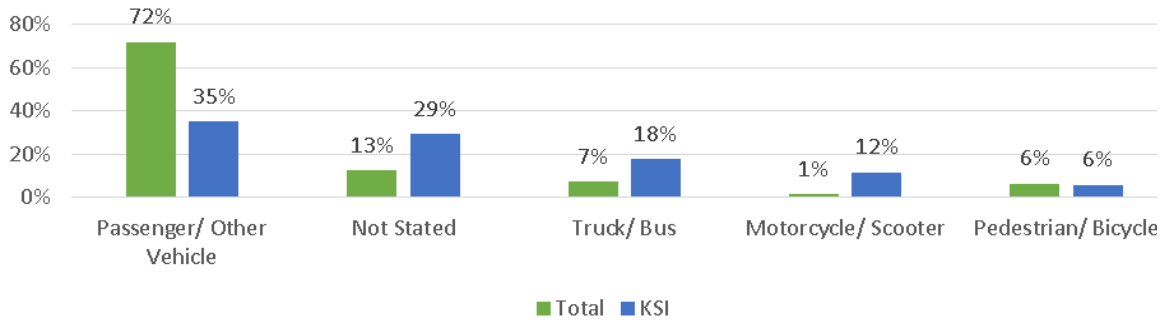
Figure 12. Motor Vehicle Involved with: All Collisions vs. KSI Collisions



MODES

In addition to motor vehicle involved with, modes include a more detailed breakdown of the vehicle type at fault in the accident, including motorcycles and trucks. For collisions of all severity, the majority were caused by passenger/other vehicles (72%), followed by (besides not stated) truck/ bus (7%). Crashes caused by passenger/other vehicles also makes up 35% of KSI collisions, followed by truck/ bus caused collisions (18%). **Figure 13** illustrates the percentage for all collisions as well as KSI collisions by mode. Note that Not Stated indicates that a particular mode was not included in the police report.

Figure 13. Modes: All Collisions vs. KSI Collisions

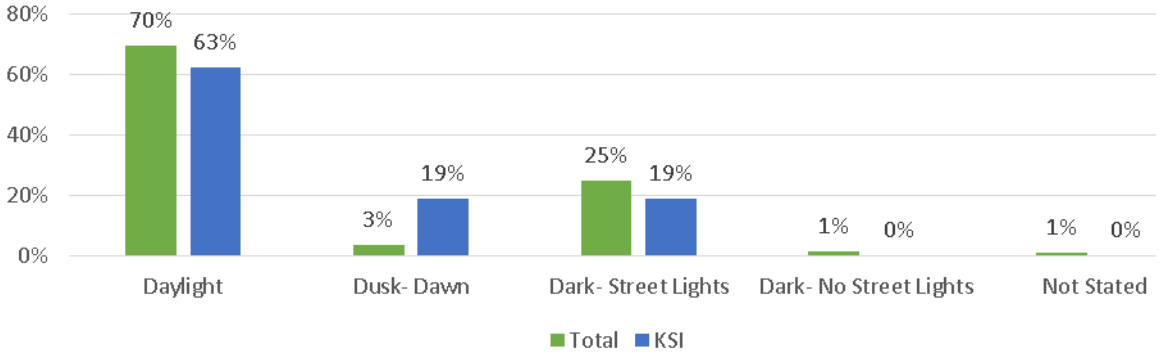


LIGHTING

For collisions of all severity, 70% of collisions occurred in daylight, while 25% of collisions occurred in the dark on streets with street lights. For KSI collisions, lighting conditions shifted slightly, with 63% of collisions having occurred in daylight, 19% of collisions occurred in dusk – dawn lighting, and 19% occurred in the dark on streets with street lights. However, according to the National Highway and Traffic Safety Administration, approximately 25% of travel occurs at night nationwide, so the percent of collisions occurring at night in Albany is proportional.

Figure 14 illustrates the lighting condition for all collisions and KSI collisions.

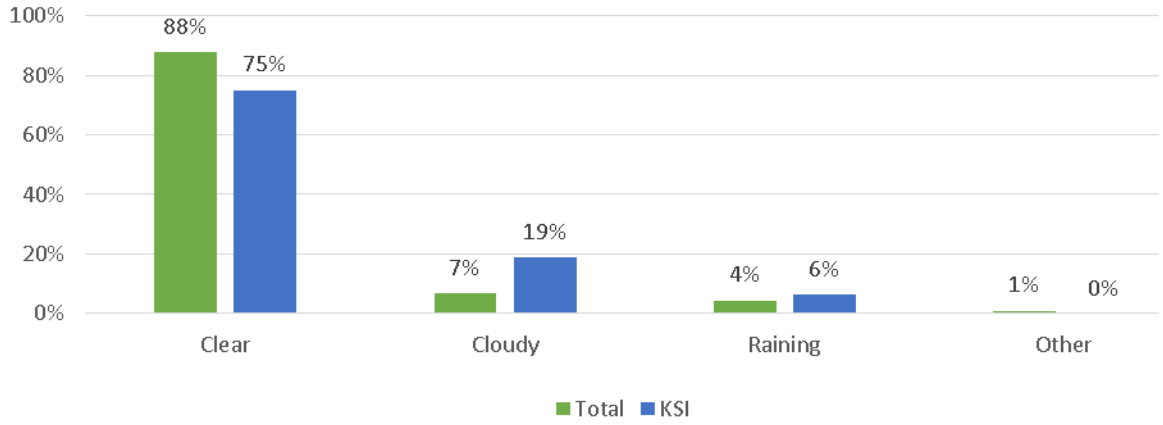
Figure 14. Lighting Conditions: All Collisions vs. KSI Collisions



WEATHER

Majority of collisions have occurred during clear weather conditions (88%). Similar trends have been observed with KSI collisions, with 75% of the collisions having occurred during clear weather conditions. **Figure 15** on the following page illustrates the percent distribution of weather conditions during occurrence of collisions of all severity as well as KSI collisions.

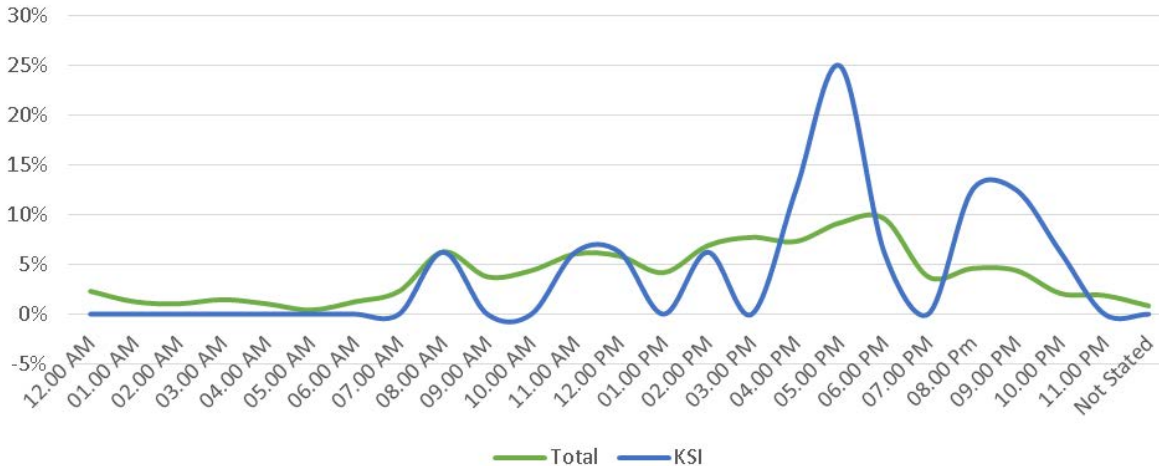
Figure 15. Weather Conditions: All Collisions vs. KSI Collisions



TIME OF THE DAY

For collisions of all severity, the hour with the most number of collisions was between 6:00 p.m. to 7:00 p.m. (10%), while the hour with the fewest number of collisions was 5:00 a.m. to 6:00 a.m. (0%). For KSI collisions, maximum number of collisions occurred between 5:00 p.m. to 6:00 p.m. (25%). **Figure 16** illustrates the percentage of collisions occurring during each hour of the day for all collisions as well as KSI collisions.

Figure 16. Time of Day: All Collisions vs. KSI Collisions



Bicycle and Pedestrian Collision Analysis

In addition, motor vehicle to bicycle, motor vehicle to pedestrian, and motor vehicle to other motor vehicle collisions were separated out and analyzed. Separating out these types of collisions will identify where each type of collision occurred along the high risk intersections and corridors in order to show patterns, risk factors, and potential solutions to improve safety for all modes as they interact with motor vehicles.

Figure 17 illustrates motor vehicle to bike collisions of all severity including KSI collisions. **Figure 18** illustrates motor vehicle to pedestrian collisions of all severity including KSI collisions. **Figure 19** illustrates motor vehicle to motor vehicle collisions of all severity including KSI collisions.

Figure 17. Motor Vehicle to Bike Collisions (2016-2020)

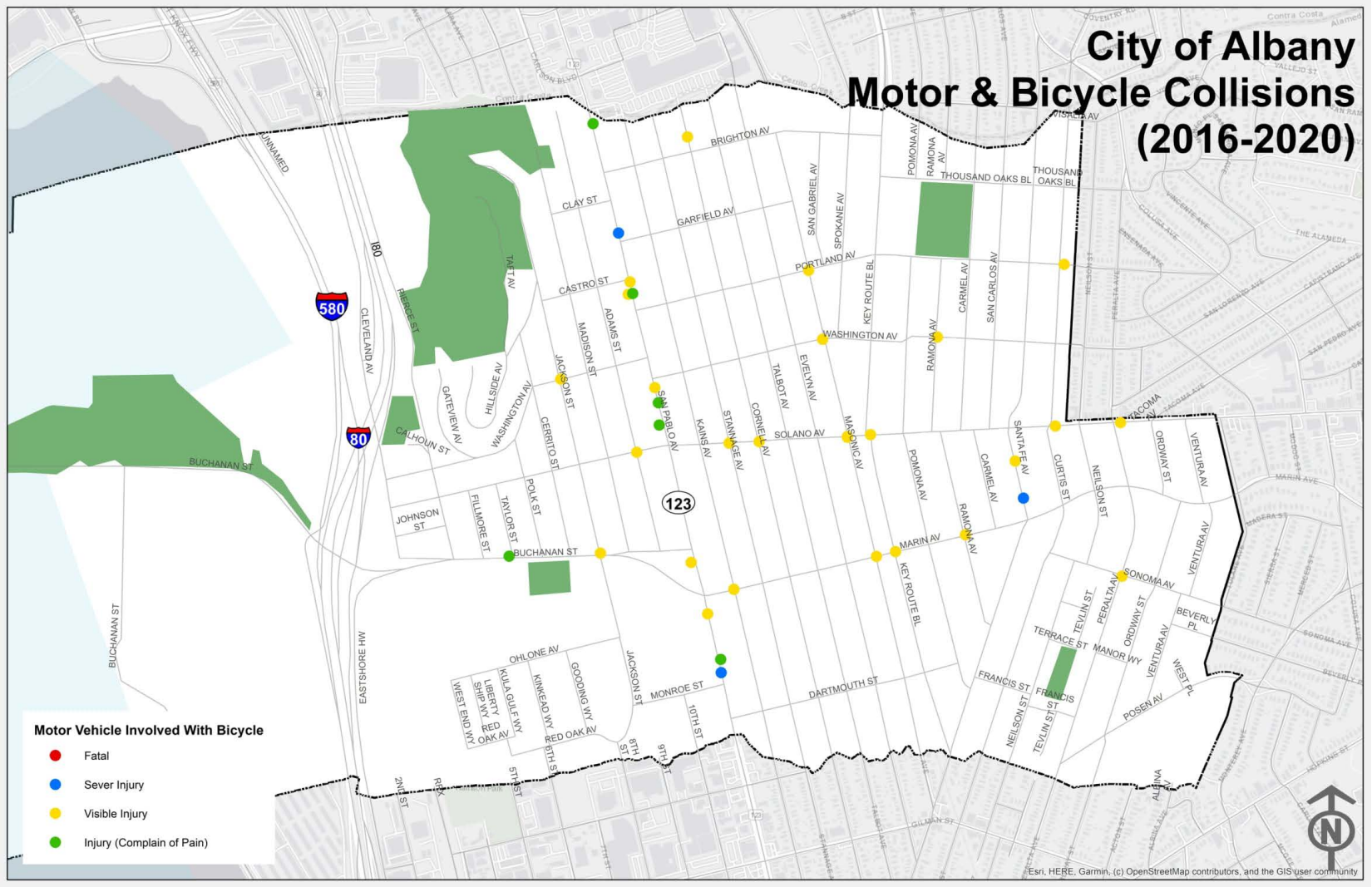


Figure 18. Motor Vehicle to Pedestrian Collisions (2016-2020)

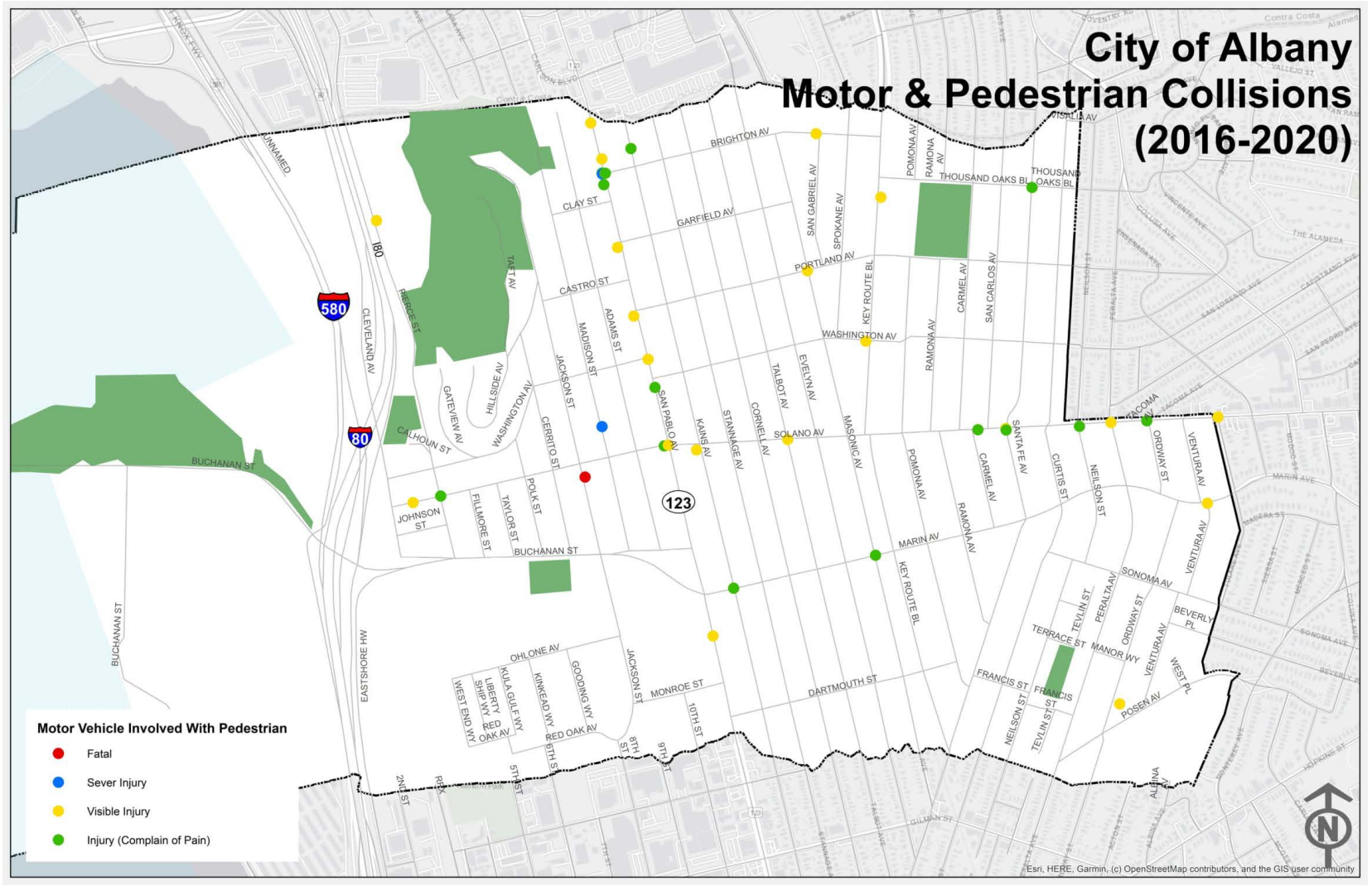
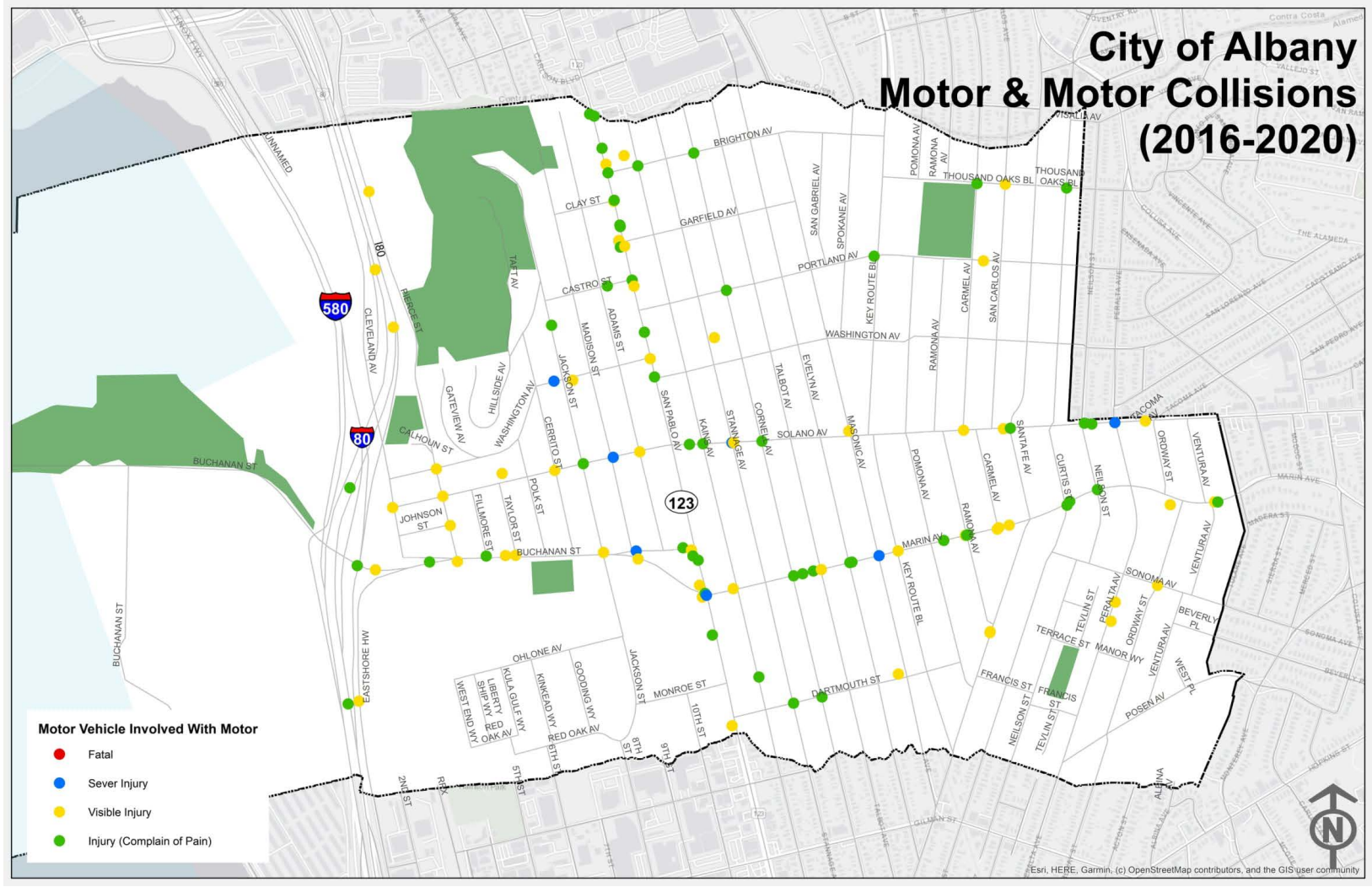


Figure 19. Motor Vehicle to Motor Vehicle Collisions (2016-2020)



KILLED AND SEVERE INJURY COLLISIONS

This section describes a detailed collision analysis performed for KSI collisions occurring at roadway segments and intersections in the City of Albany. Of the total 16 KSI collisions that occurred during the study period, 14 collisions (88%) occurred at intersections and two collisions (12%) occurred on roadway segments. Note that KSI collisions represent a small percentage of the overall number of collisions in Albany, but are still examined to determine the factors leading to them because of the focus the LRSP has on these types of collisions. This distribution is illustrated in **Figure 20.**

Figure 20. Intersection vs. Roadway Segment Collisions – KSI Collisions

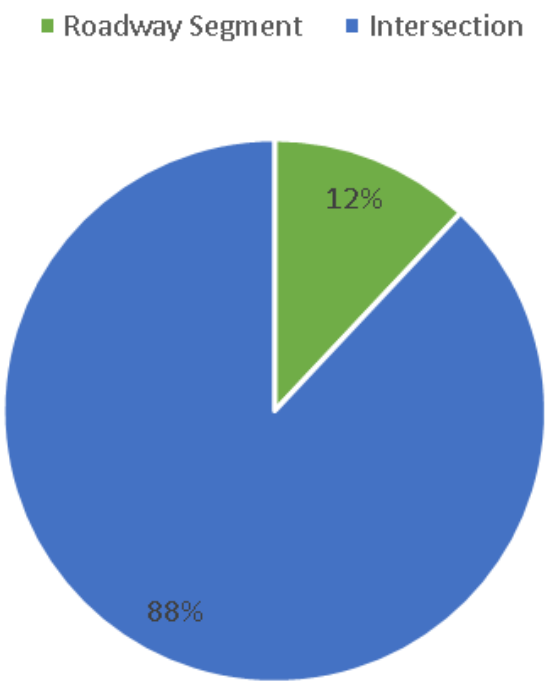
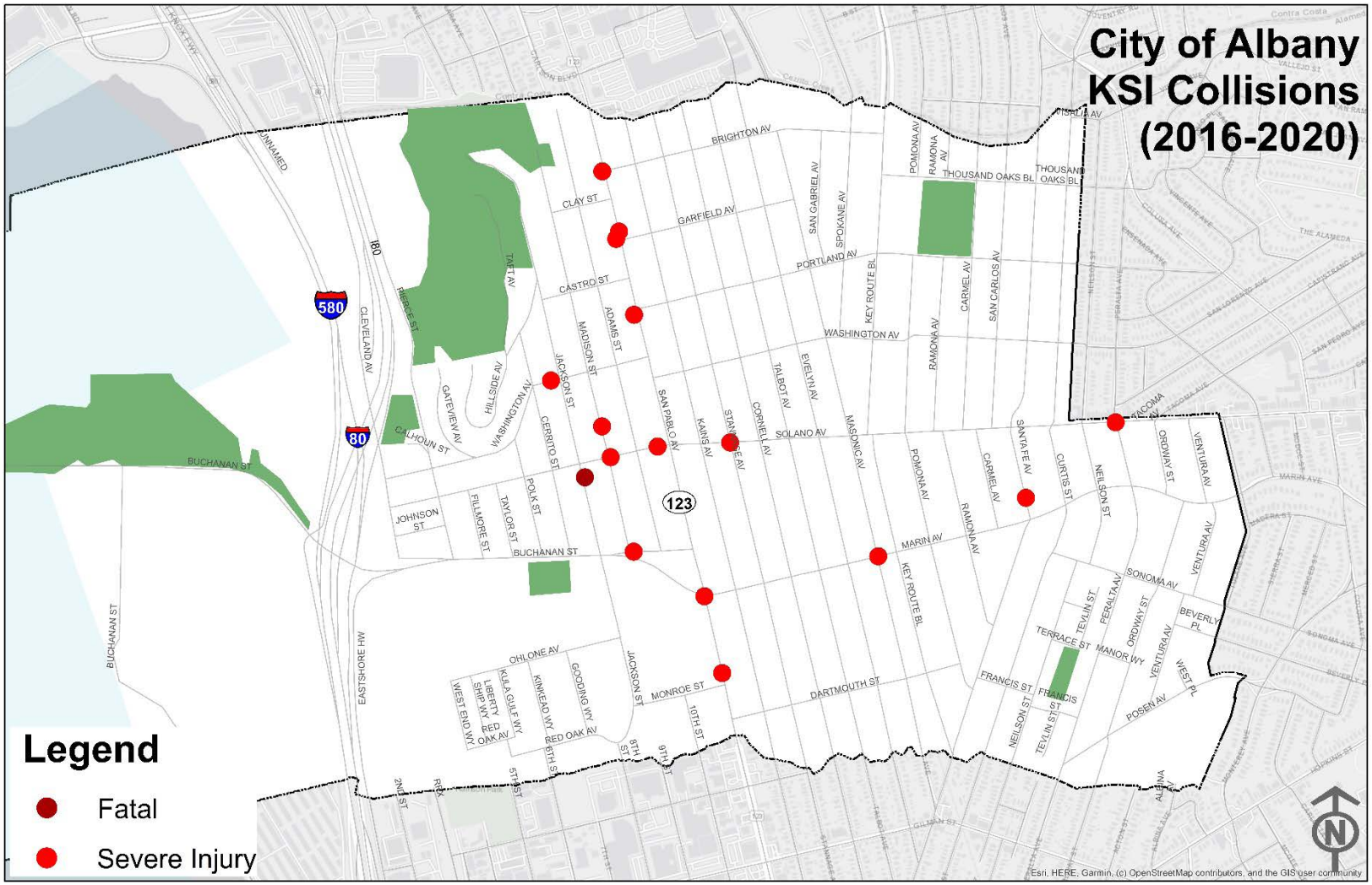


Figure 21 maps the KSI collisions that occurred in the City of Albany during the study period.

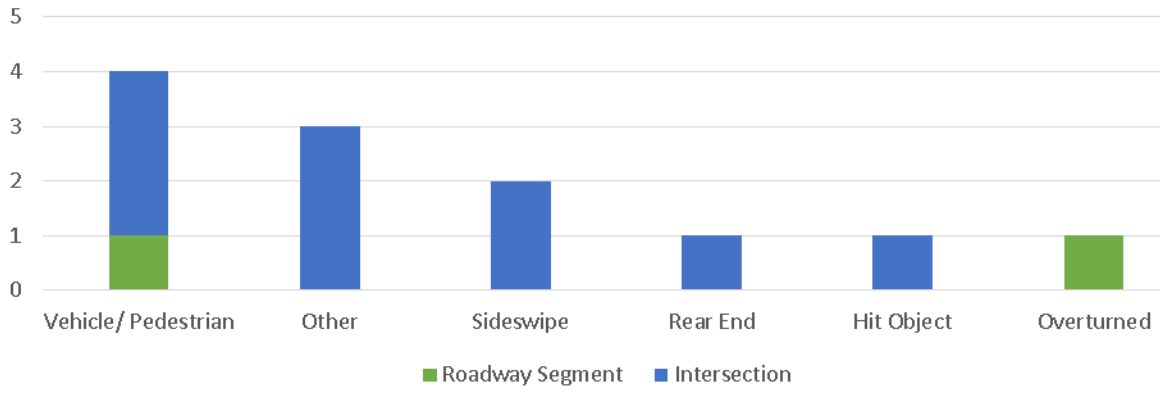
Figure 21. KSI Collisions in the City of Albany (2016-2020)



COLLISION TYPE AND LOCATION TYPE

The most common KSI collision type was broadside collisions, which most commonly occurred at intersections. Besides other, broadside collisions were followed by vehicle/ pedestrian collisions and sideswipe collisions as the most common intersection KSI collisions, while overturned and vehicle/ pedestrian collisions occurred on roadway segments. **Figure 22** shows KSI collisions location type as well as the collision type.

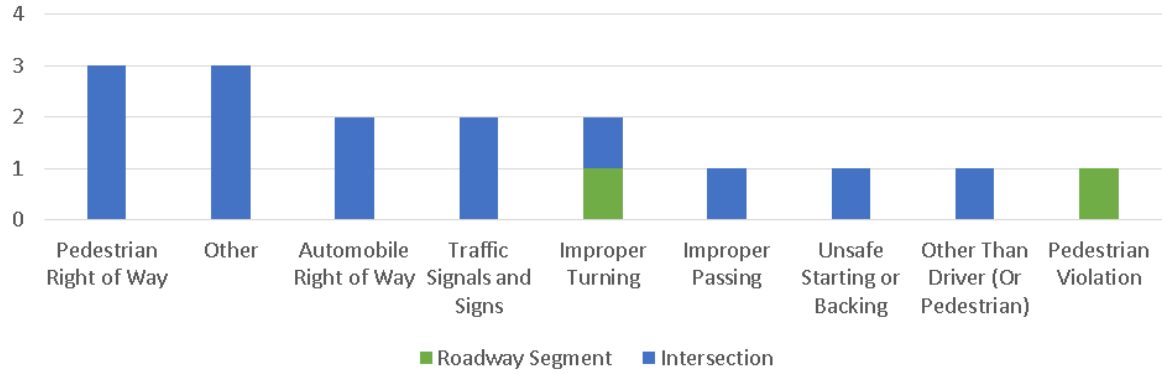
Figure 22. KSI Collisions: Collision Type vs Location Type (2016-2020)



VIOLATION CATEGORY AND LOCATION TYPE

The most common KSI violation type (besides other) were pedestrian right of way collisions at intersections, followed by automobile right of way and traffic signals and signs violations. On roadway segments, the violation categories were improper turning and pedestrian violation. **Figure 23** shows KSI collisions by the location type and violation category.

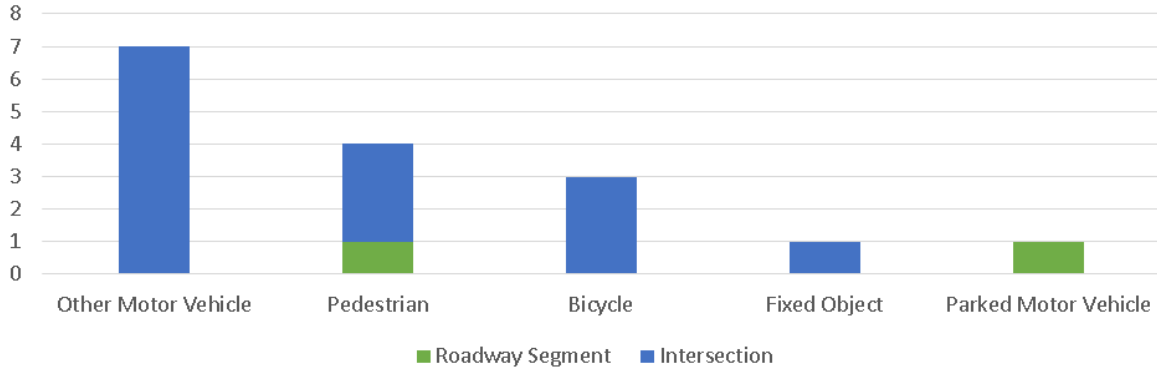
Figure 23. KSI Collisions: Violation Category vs Location Type (2016-2020)



MOTOR VEHICLE INVOLVED WITH AND LOCATION TYPE

KSI collisions involving other motor vehicle (seven collisions), followed by pedestrian (four collisions) and bicycle each (three collisions) were the most common types occurring at intersection. Pedestrian collisions and collisions with parked motor vehicles occurred on roadway segments. **Figure 24** shows KSI collisions by location type and motor vehicle involved with.

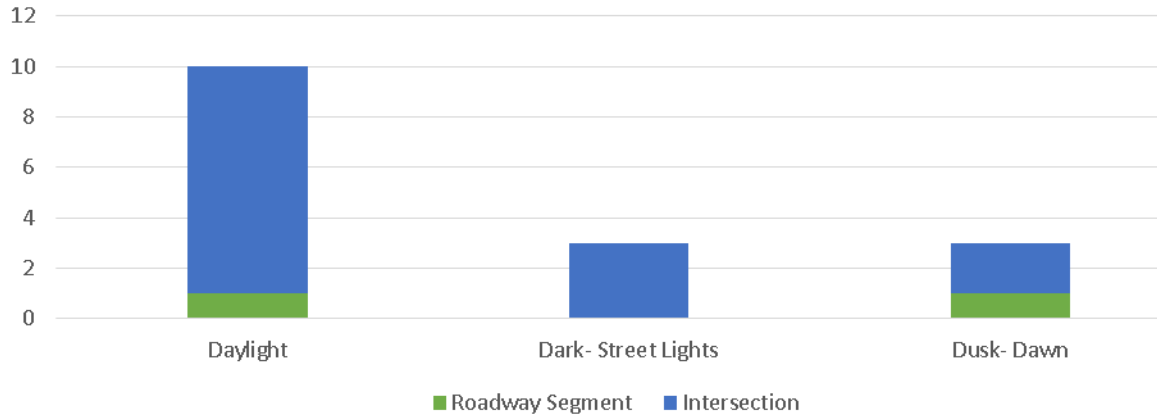
Figure 24. KSI Collisions: Motor Vehicle Involved With vs Location Type (2016-2020)



LIGHTING AND LOCATION TYPE

Most KSI collisions occurred in daylight at intersections. The second most common lighting for KSI collisions was collisions that occurred in the dark on streets with street lights at intersections, and at dawn/dusk at intersections. **Figure 25** shows KSI collisions by location type as well as lighting conditions.

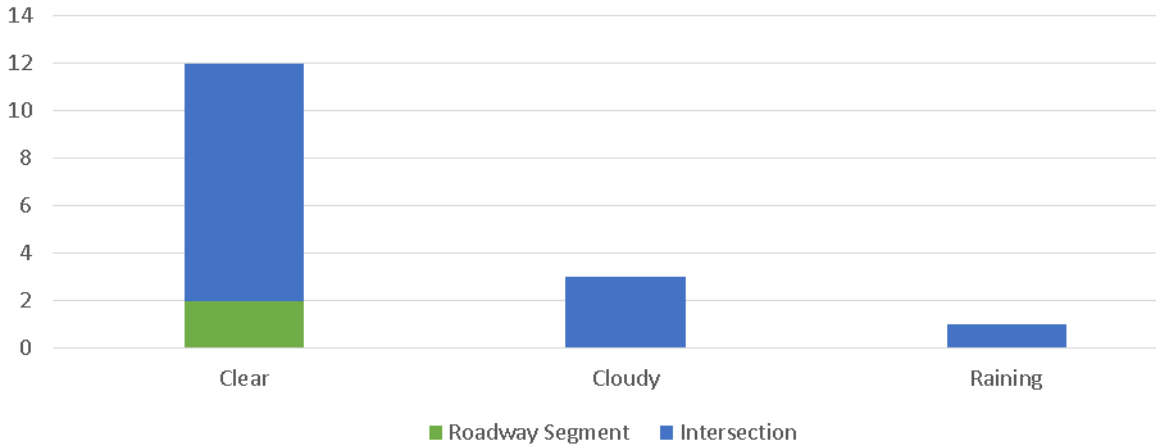
Figure 25. KSI Collisions: Lighting vs Location Type (2016-2020)



WEATHER AND LOCATION TYPE

The majority of KSI collisions occurred during clear weather at both intersections and along roadway segments. **Figure 26** shows KSI collisions by location type as well as weather conditions.

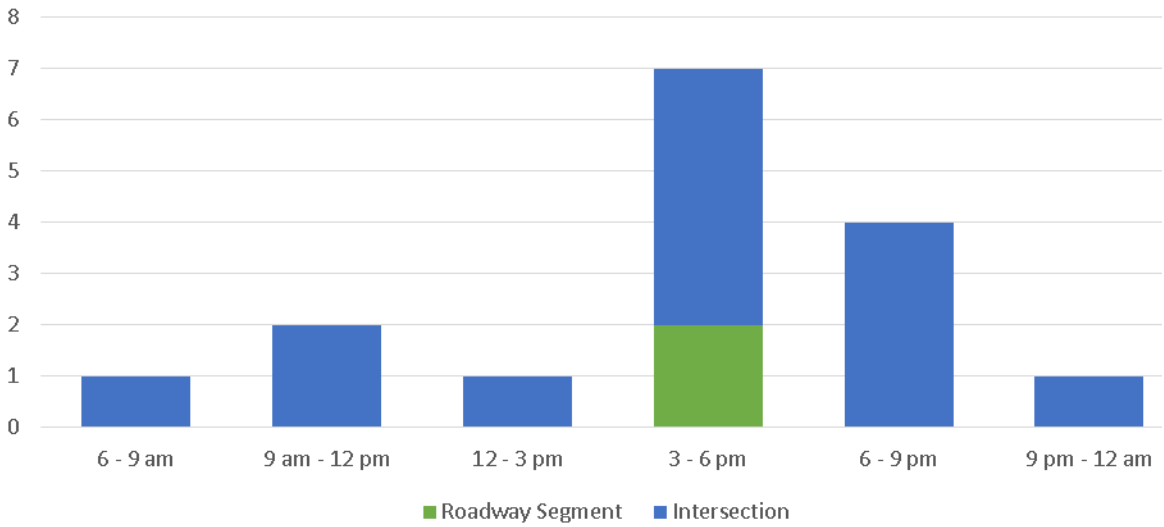
Figure 26. KSI Collisions: Weather vs Location Type (2016-2020)



TIME OF DAY AND LOCATION TYPE

The time period with the most KSI collisions at intersections was during 3:00 p.m. to 6:00 p.m., followed by 6:00 p.m. to 9:00 p.m. Both roadway segment KSI collisions occurred between 3:00 p.m. to 6:00 p.m. **Figure 27** shows KSI collisions by location type and time of day.

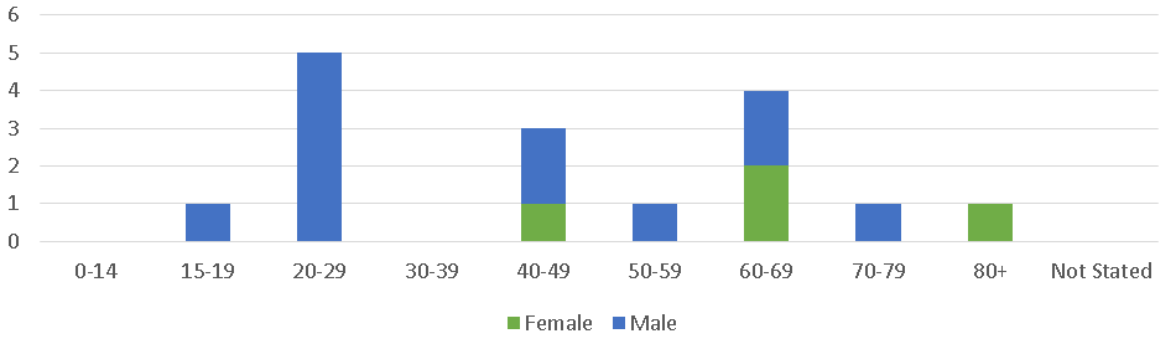
Figure 27. KSI Collisions: Time of Day vs Location Type (2016-2020)



GENDER VS. AGE

For KSI collisions, the gender of the party at fault was much more likely to be male than female (75% of KSI collisions were caused by a male). The party at fault was also slightly more likely to be older. Parties at fault over 40 years of age accounts for more than half (63%) of all KSI collisions. **Figure 28** illustrates the gender and age of the party at fault for KSI collisions.

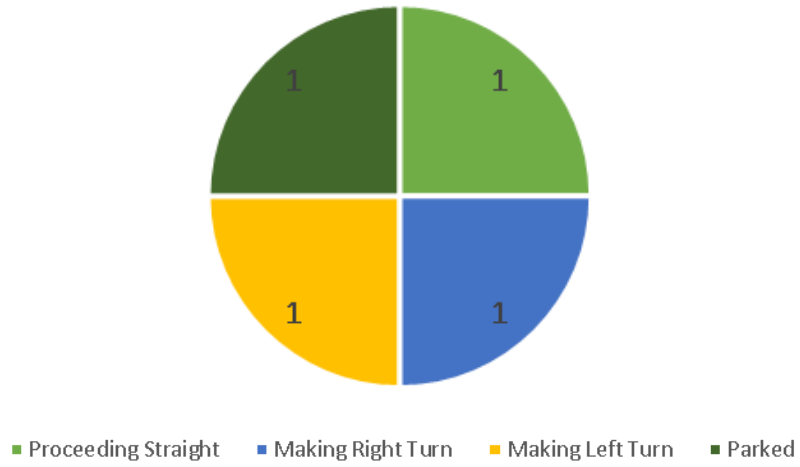
Figure 28. KSI Collisions by Gender and Age



COLLISION TYPE VS. MOVEMENT PRECEDING COLLISION OF PARTY AT FAULT

The most common type of collision (besides other) for KSI collisions was broadside collisions. Of these collisions, the movement preceding the collision includes proceeding straight, making right turn, making left turn, and parked (one collision each). Overall, each collision type did not show a strong concentration of movements preceding the collisions, with no one collision type/movement preceding combination exceeding one. As an example, **Figure 29** shows this distribution of movement preceding each KSI broadside collision.

Figure 29. KSI Collisions by Broadside Collisions and Movement Preceding Collision of Party at Fault



Bicycle and Pedestrian Collision Analysis

The Bicycle and Pedestrian analysis is studied to find out the movement and behavior of pedestrians and bicyclists in the City of Albany. This analysis identifies pedestrian and bike issues such as high risk intersections and corridors and target safety interventions to reduce the number of collisions and improve the safety of pedestrian and bicyclists. It also identifies patterns, risk factors, and potential solutions to improve safety for both modes.

Figure 30 illustrates bicycle collisions of all severity including KSI collisions. **Figure 31** illustrates pedestrian collisions of all severity including KSI collisions. **Figure 32** illustrates bicycle and pedestrian collisions of all severity including KSI collisions. **Figure 33** illustrates only KSI collisions involving bicycles. **Figure 34** illustrates only KSI collisions involving pedestrians. **Figure 35** illustrates KSI collisions for both bicycle and pedestrians.

Figure 30. Bicycle Collisions: All Injury Collisions (2016-2020)

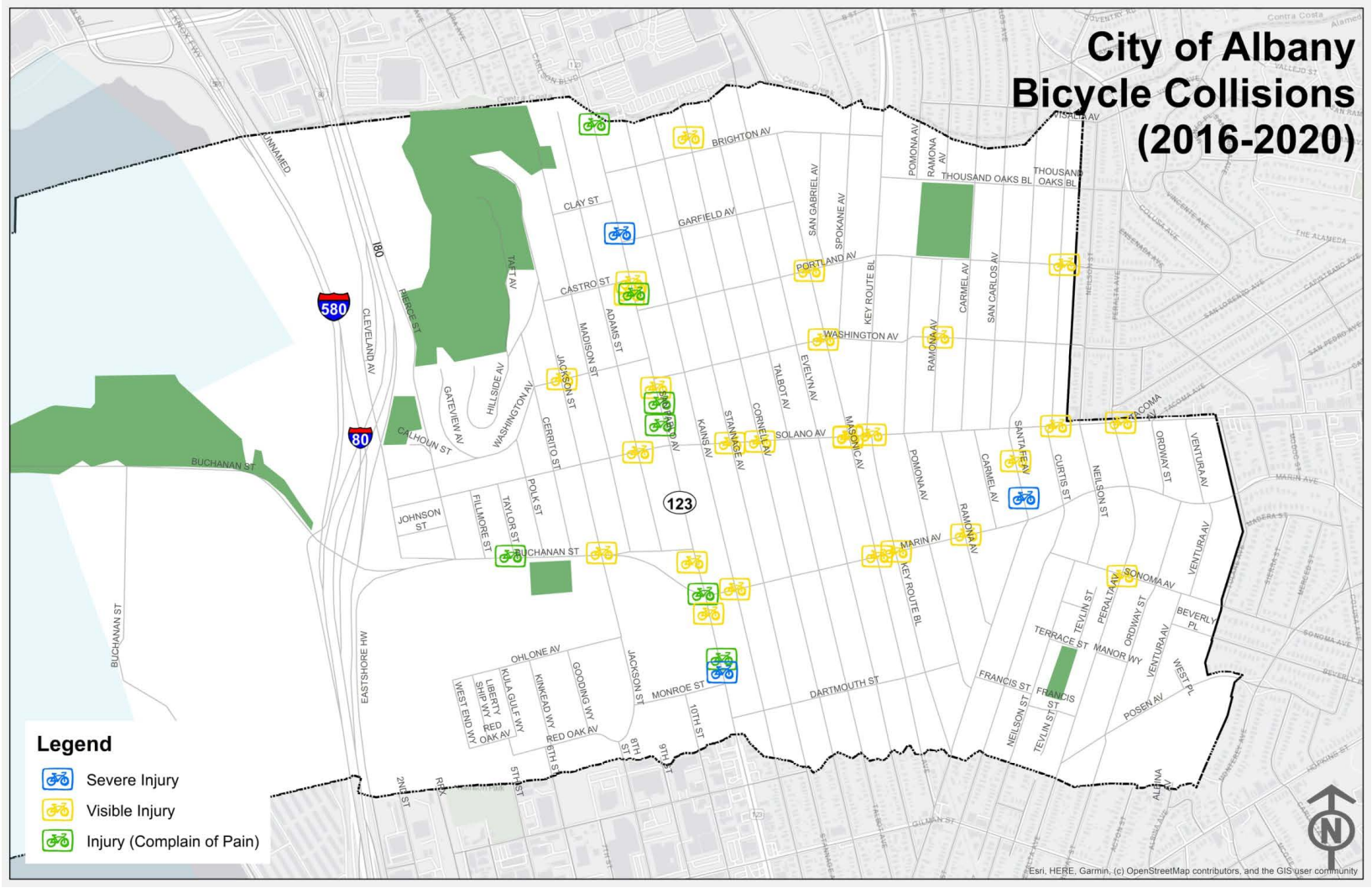


Figure 31. Pedestrian Collisions: All Injury Collisions (2016-2020)

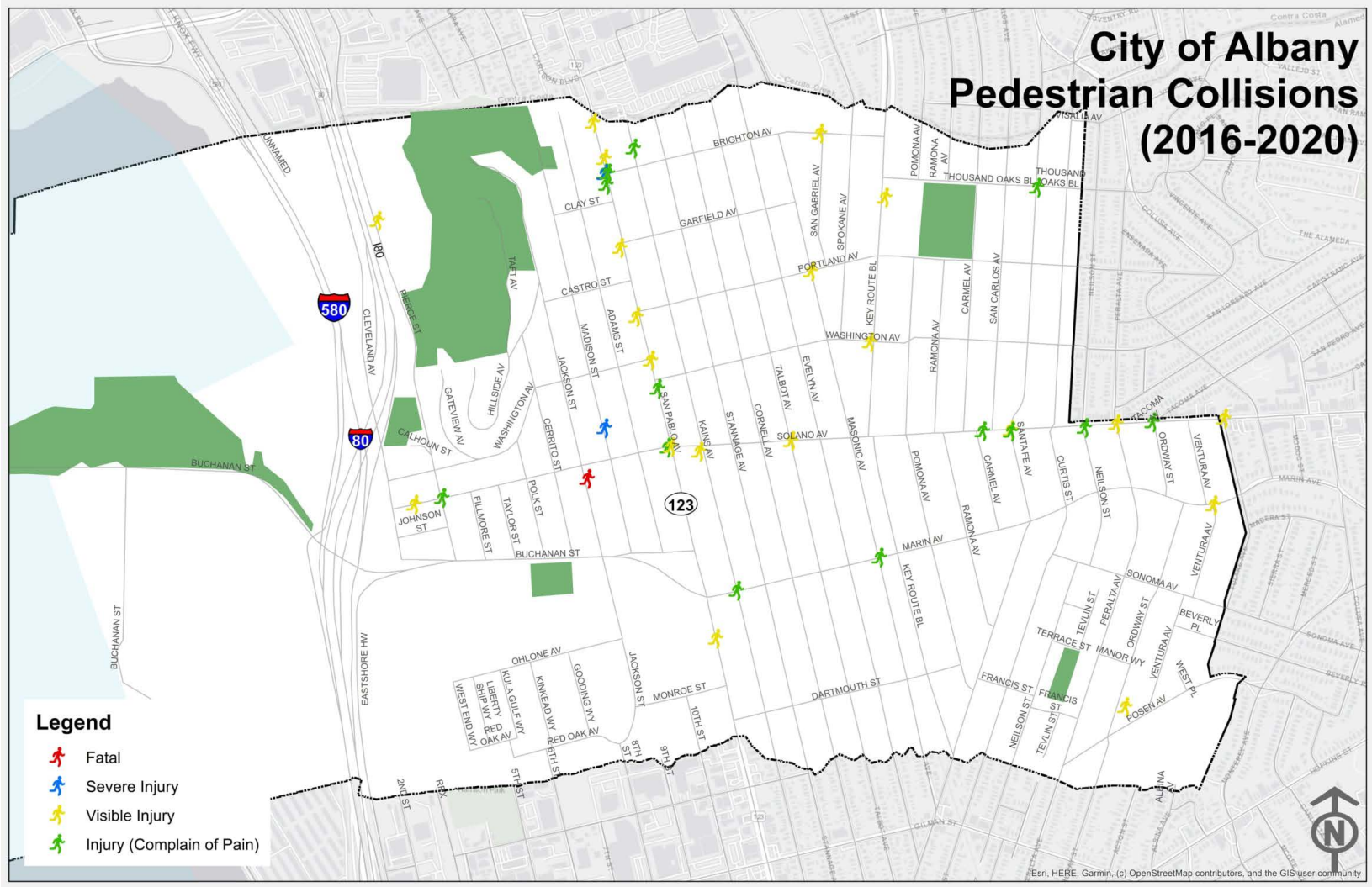


Figure 32. Bike and Pedestrian Collisions: All Injury Collisions (2016-2020)

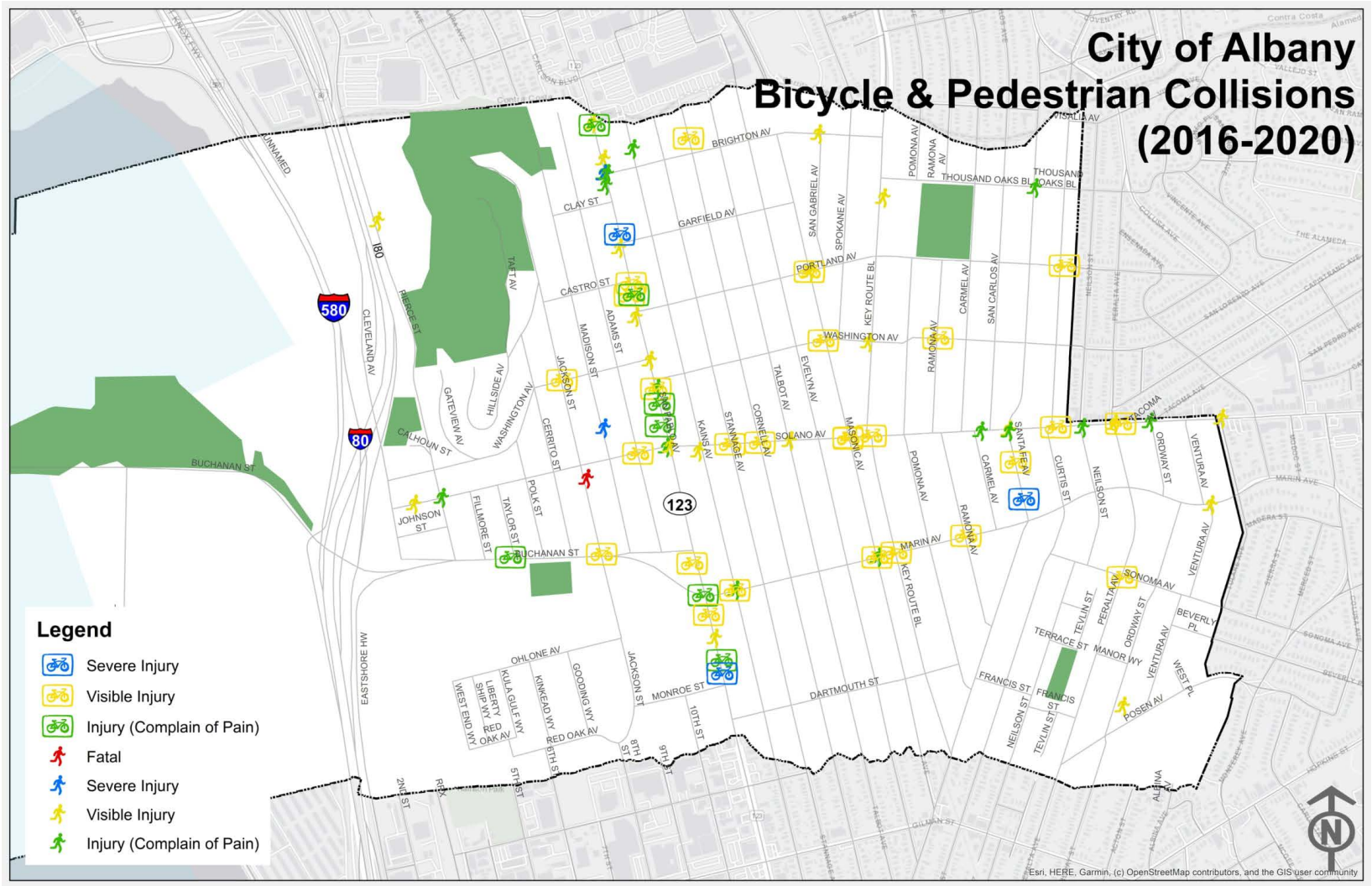


Figure 33. Bike Collisions: Killed and Severe Injury Collisions (2016-2020)

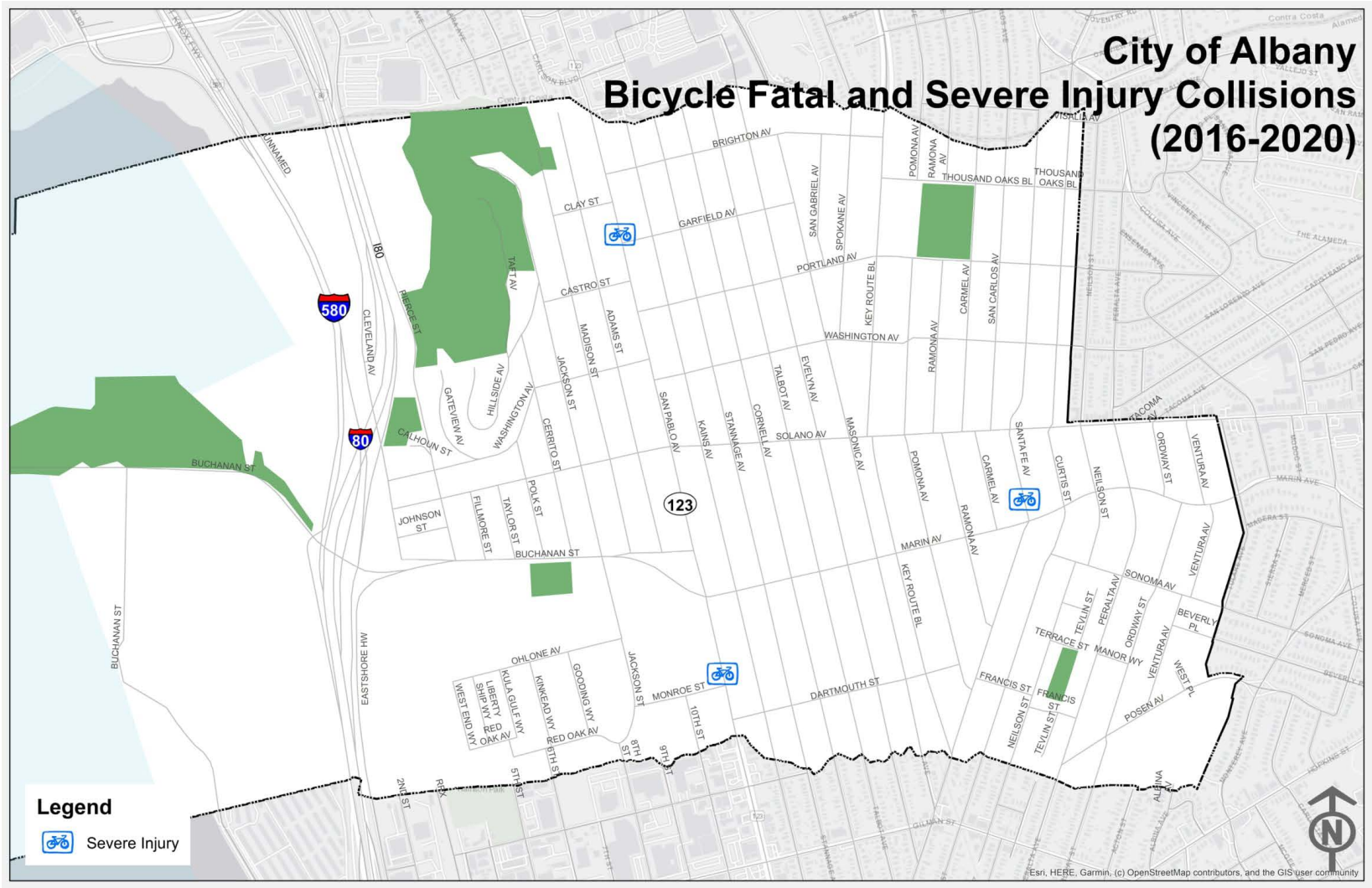


Figure 34. Pedestrian Collisions: Killed and Severe Injury Collisions (2016-2020)

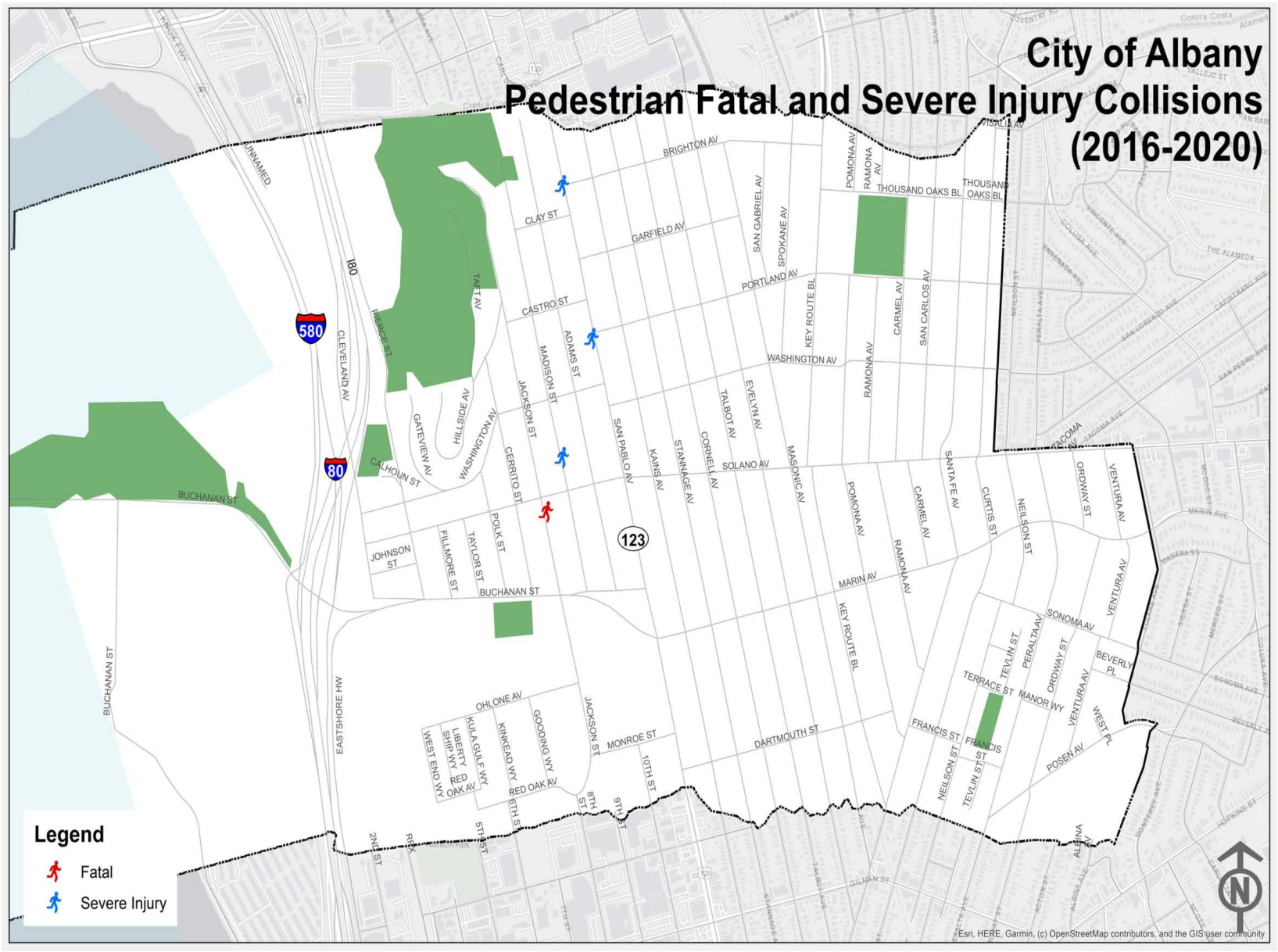
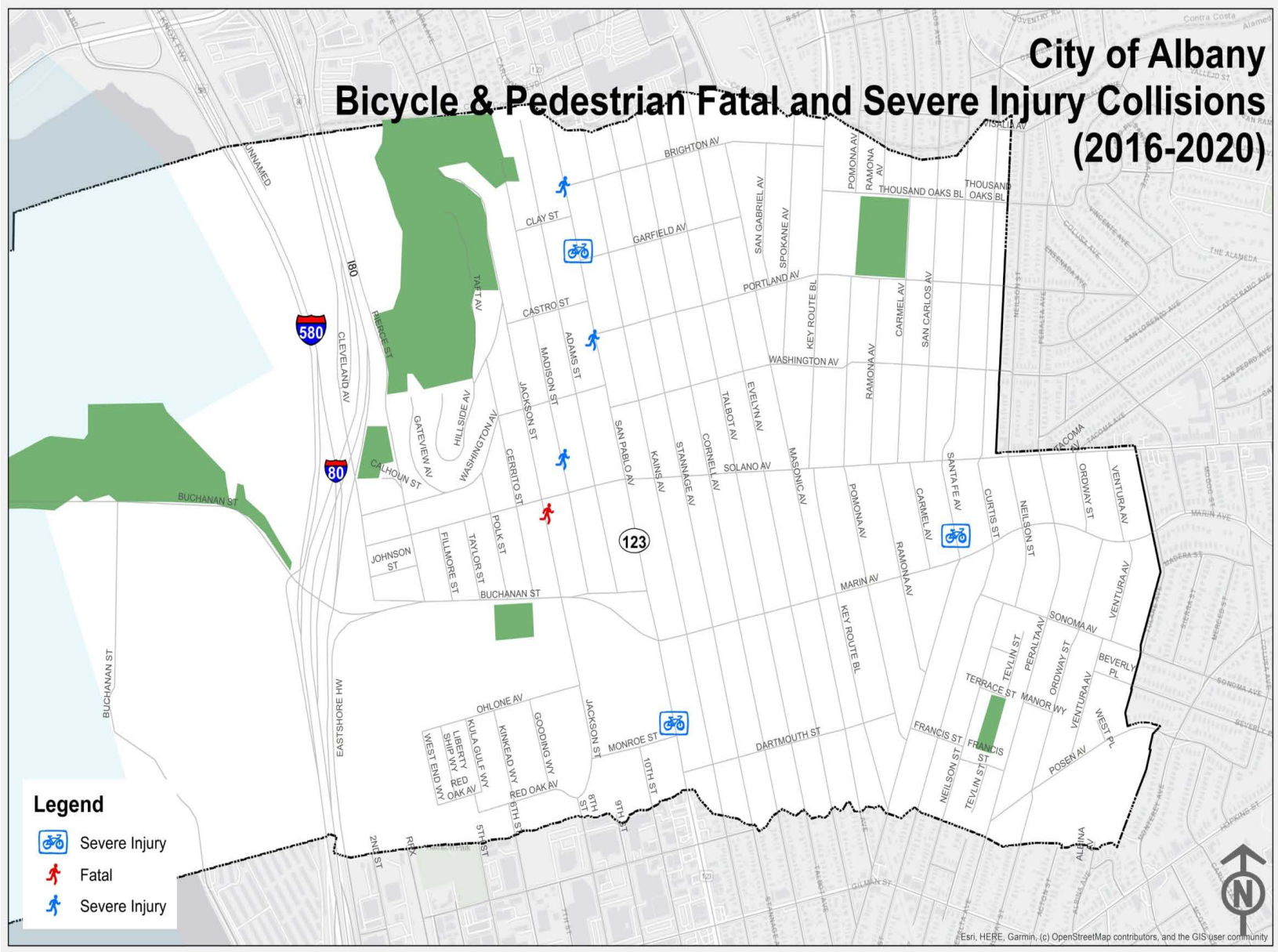


Figure 35. Bike and Pedestrian Collisions: Killed and Severe Injury Collisions (2016-2020)



Geographic Collision Analysis

This section describes a detailed geographic collision analysis performed for injury collisions occurring on roadway segments and at intersections in the City of Albany. The above collision analysis was used to identify five main collision factors that highlight the top trends among collisions in Albany. These five collision factors were identified to be broadside collisions, improper turning collisions, pedestrian collisions, bicycle collisions, and rear end collisions.

BROADSIDE COLLISIONS

For KSI collisions in Albany, 25% of collisions were broadside collisions. This is slightly higher than its share of collisions of all severity (22%). **Figure 36** shows the distribution of broadside collisions throughout the City of Albany between 2016 and 2020.

IMPROPER TURNING COLLISIONS

For KSI collisions in the City of Albany, 13% of collisions occurred due to improper turning violation, the most of any category. It also contributed to 19% of all collisions. **Figure 37** shows the distribution of improper turning collisions throughout the City of Albany between 2016 and 2020.

PEDESTRIAN COLLISIONS

25% of KSI collisions in Albany involved a pedestrian, compared to just 8% of collisions of all severity. **Figure 38** shows the distribution of pedestrian collisions throughout the City of Albany between 2016 and 2020.

BICYCLE COLLISIONS

19% of KSI collisions in Albany involved a bicycle, compared to 8% of collisions of all severity. **Figure 39** shows the distribution of bicycle collisions throughout the City of Albany between 2016 and 2020.

REAR END COLLISIONS

26% of collisions of all severity were rear end collisions, the most of all collision types. It also makes up 6% of KSI collisions. **Figure 40** shows the distribution of rear end collisions throughout the City of Albany between 2016 and 2020.

Figure 36. City of Albany Broadside Collisions (2016-2020)

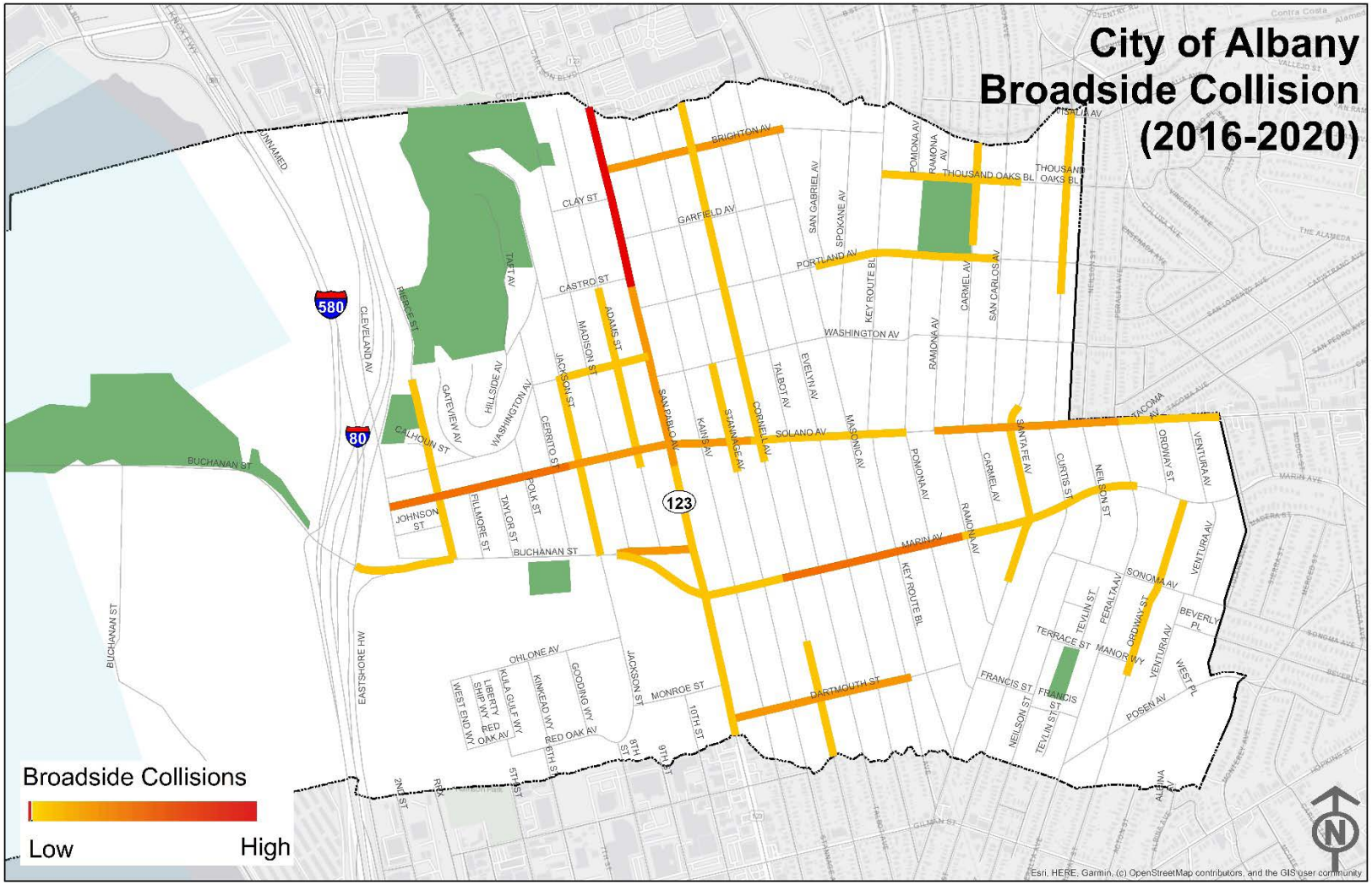


Figure 37. City of Albany Improper Turning Collisions (2016-2020)

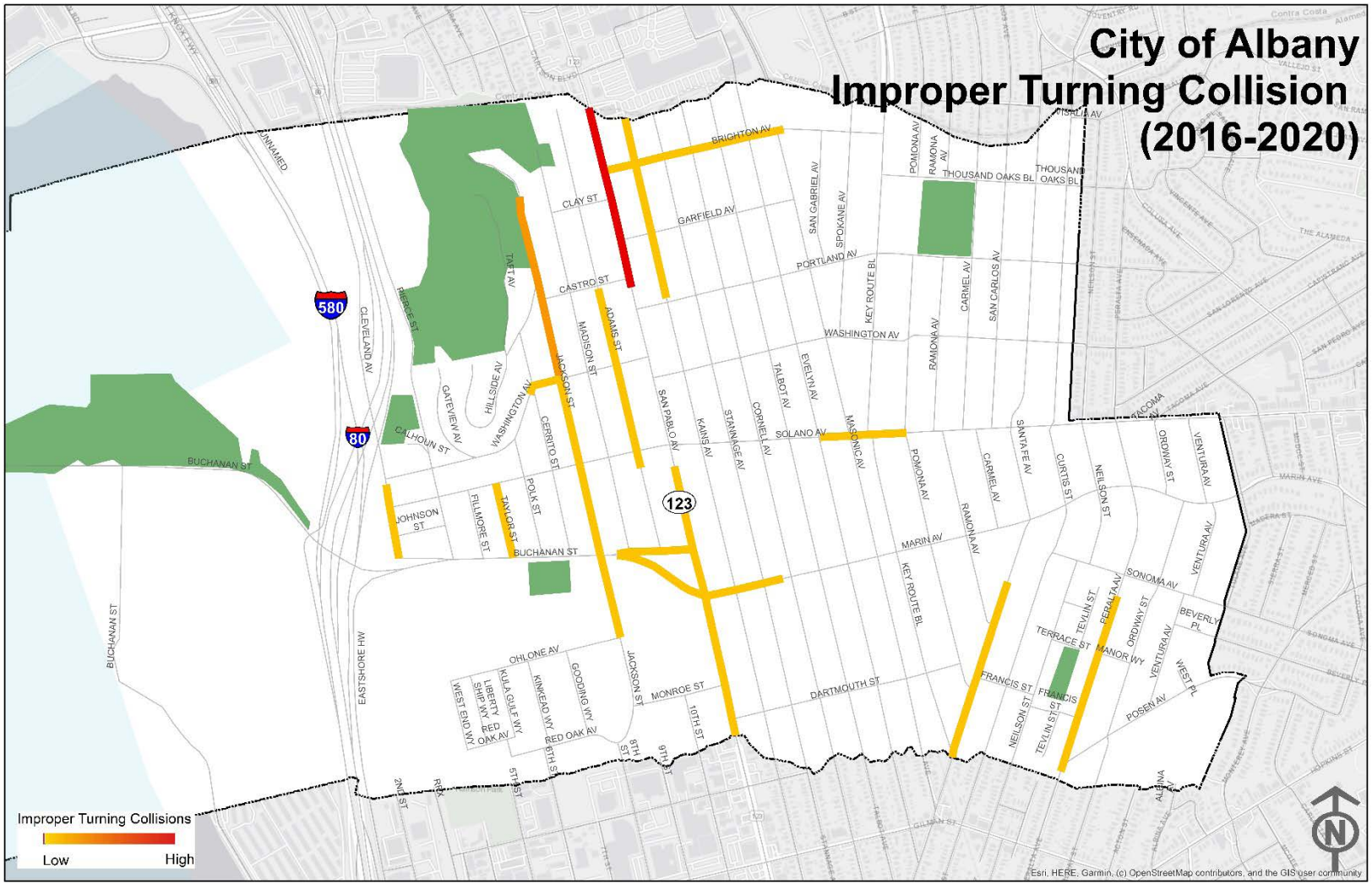


Figure 38. City of Albany Pedestrian Collisions (2016-2020)

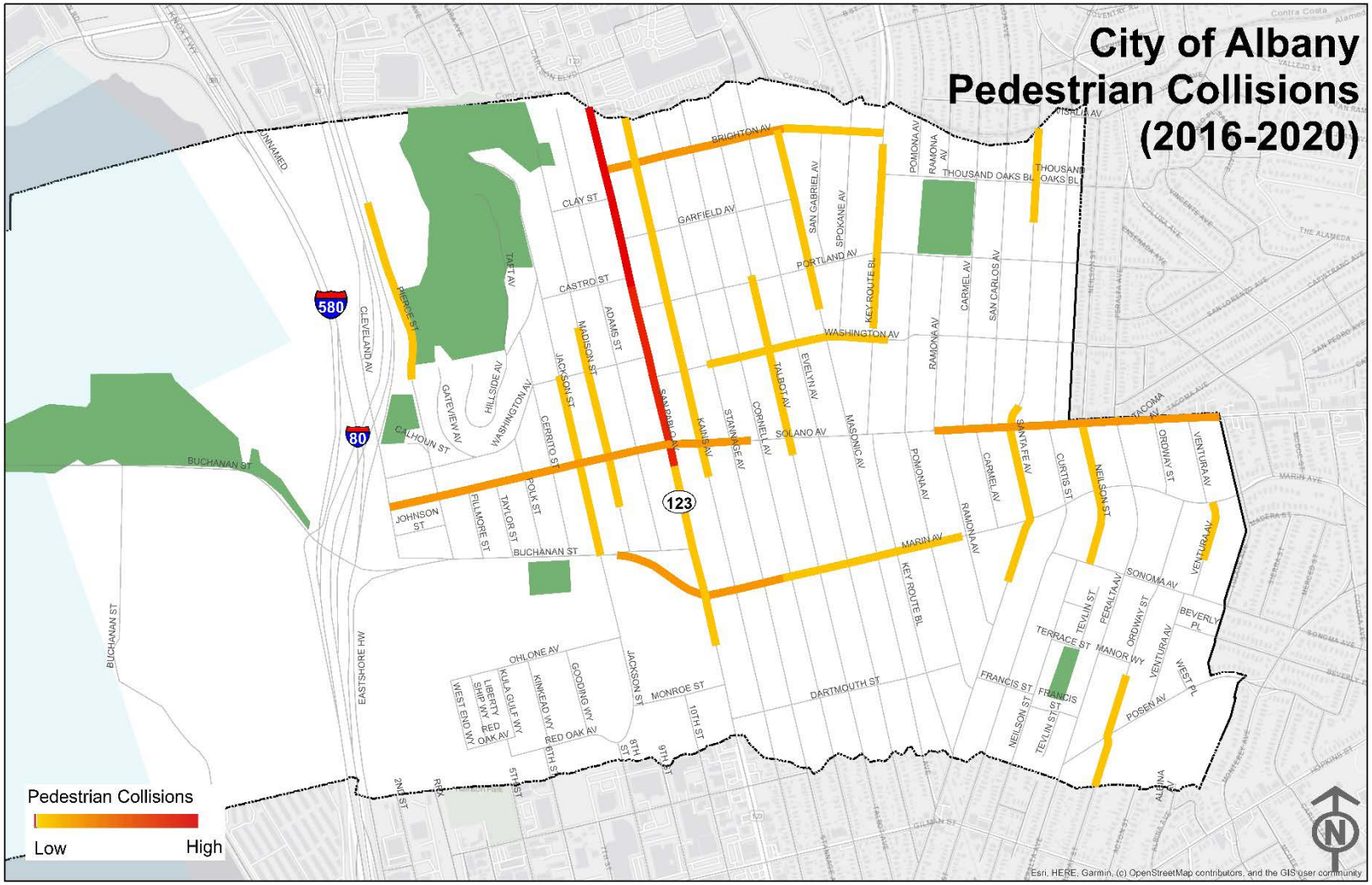


Figure 39. City of Albany Bicycle Collisions (2016-2020)

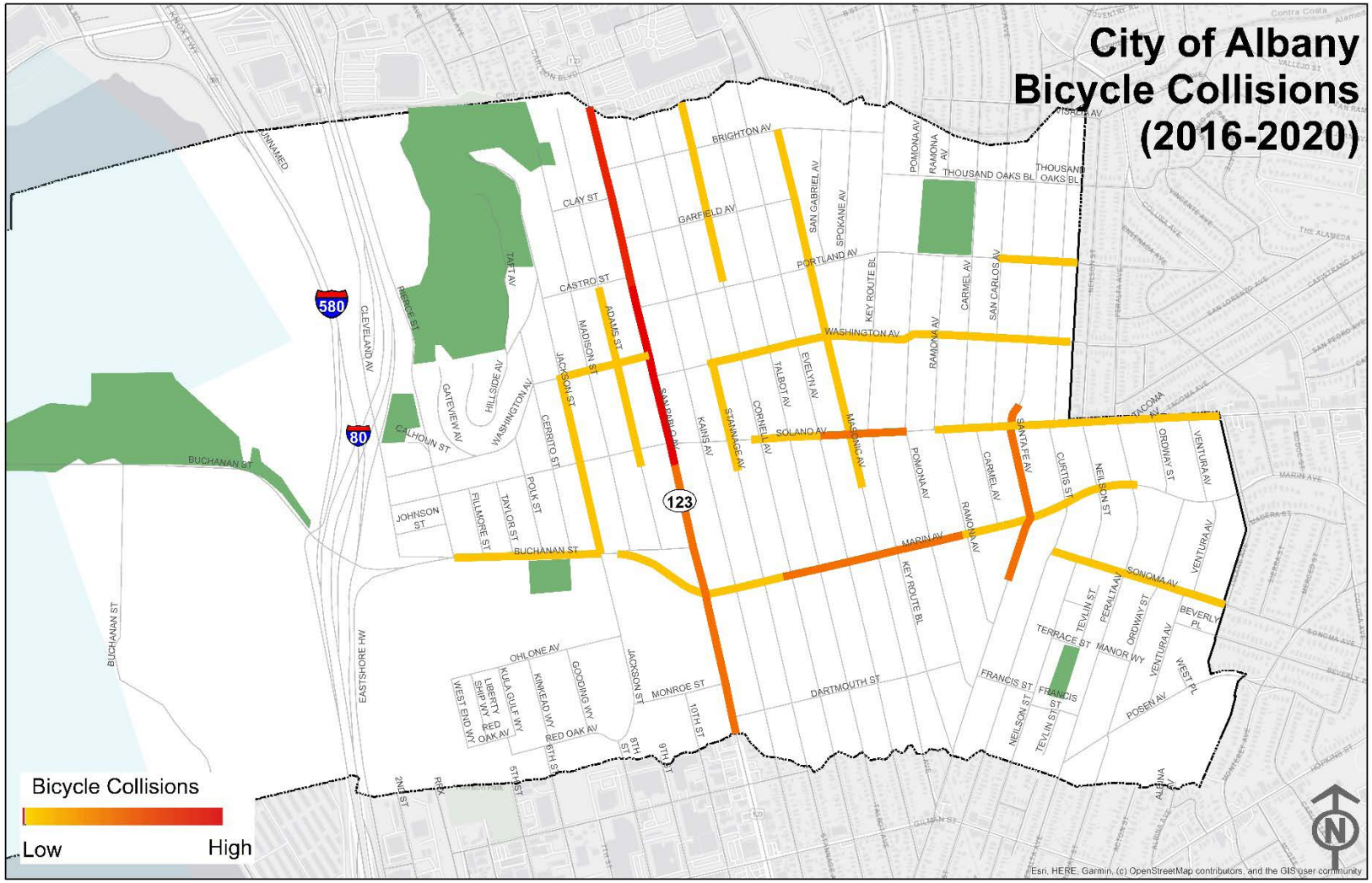
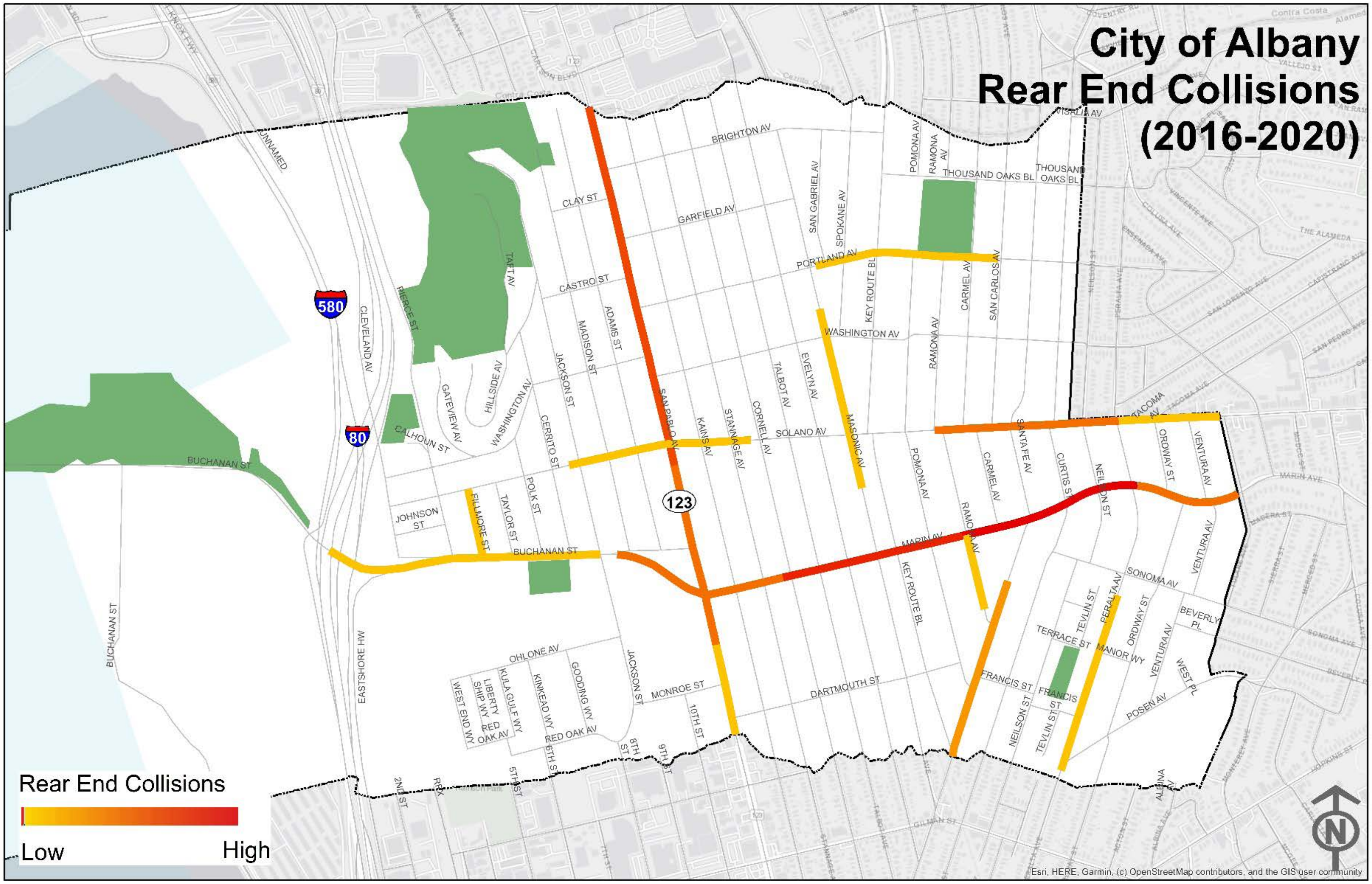


Figure 40. City of Albany Rear End Collisions (2016-2020)


City of Albany
Rear End Collisions
(2016-2020)
Rear End Collisions
Low
High
580
80
123
BRIGHTON AV
CLAY ST
GARFIELD AV
CASTRO ST
PORTLAND AV
WASHINGTON AV
SOLANO AV
MARIN AV
BUCHANAN ST
SAN PABLO AV
MASONIC AV
THOUSAND OAKS BL
CLEVELAND AV
EASTSHORE HW
JACKSON ST
MONROE ST
DARTMOUTH ST
OHLONE AV
SONOMA AV
TERRACE ST
FRANCIS ST
POSEN AV
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Collision Severity Weight

A collision severity weight was used to identify the high severity collision network, using the Equivalent Property Damage Only (EPDO) method. The EPDO method accounts for both the severity and frequency of collisions by converting each collision to an equivalent number of PDO (Property Damage Only) collisions. The EPDO method assigns a crash cost and score to each collision according to the severity of the crash weighted by the comprehensive crash cost. These EPDO scores are calculated using a simplified version of the comprehensive crash costs per HSIP Cycle 10 application. The weights used in the analysis are shown below in **Table 3.**

Table 3. EPDO Score used in HSIP Cycle 10

Collision Severity	EPDO Score
KSI Combined	165*
Visible Injury	11
Possible Injury	6
PDO	1

*This is the score used in HSIP Cycle 10 for collisions on roadways segments, to simplify the analysis this study uses the same score for all KSI collisions regardless of location.

EPDO is used because it provides a methodology for the project team to understand the locations in Albany that are experiencing the most severe crashes. Because of the high score given to killed and severe injury crashes, locations that have these types of crashes are more likely to receive a higher EPDO score than other locations that may have more collisions, but fewer fatal or severe injury collisions. Locations that have the highest EPDO Equivalent Property Damage Only (EPDO) scores are selected for inclusion in the high collision network, shown in the next section. Identifying the locations with the most severe crashes allows the team to focus recommended solutions and countermeasures at these locations.

Identified intersections are scored based on injury collisions occurring at or within 250 feet of the intersection, while roadway segment locations are identified based on injury collisions that occur along the segment, except directly at an intersection (0 feet from intersection per SWITRS and TIMS data). Note that this is slightly different from the methodology used in the collision trend analysis, where roadway segments were defined as collisions occurring more than 250 feet from an intersection. The reason for this change is to be in line with which collisions are utilized for each type of HSIP application, where roadway segment applications can include collisions not occurring at 0 feet from intersection. Therefore, high injury corridors are identified using these collisions, rather than only collisions that occurred over 250 feet from an intersection. Intersection applications can use collisions up to 250 feet away from the intersection; therefore, high-injury intersections are identified using these collisions.

The EPDO scores for all collisions can then be aggregated in a variety of ways to identify collision patterns, such as location hot-spots. The weighted injury collisions (PDO not included) were geolocated onto the City of Albany's road network. **Figure 41** shows the location and geographic concentration of collisions by their EPDO score ranging from high to low. For context, the highest total EPDO score (including intersection and roadway segment collisions), is 705, while the lowest shown on the map is six. The severity scale shown on the map is corresponded to the highest and lowest EPDO scores in Albany. **Figure 42** indicates where the same EPDO score is overlaid on a map of disadvantaged communities, based on the Calenviroscreen 4.0 poverty percentile. To give context on how Albany compares to other cities, according to the California Office of Traffic Safety, Albany ranks at 16 out of 103 similar sized cities statewide in number of victims killed or injured.

Figure 41. City of Albany Severity Index

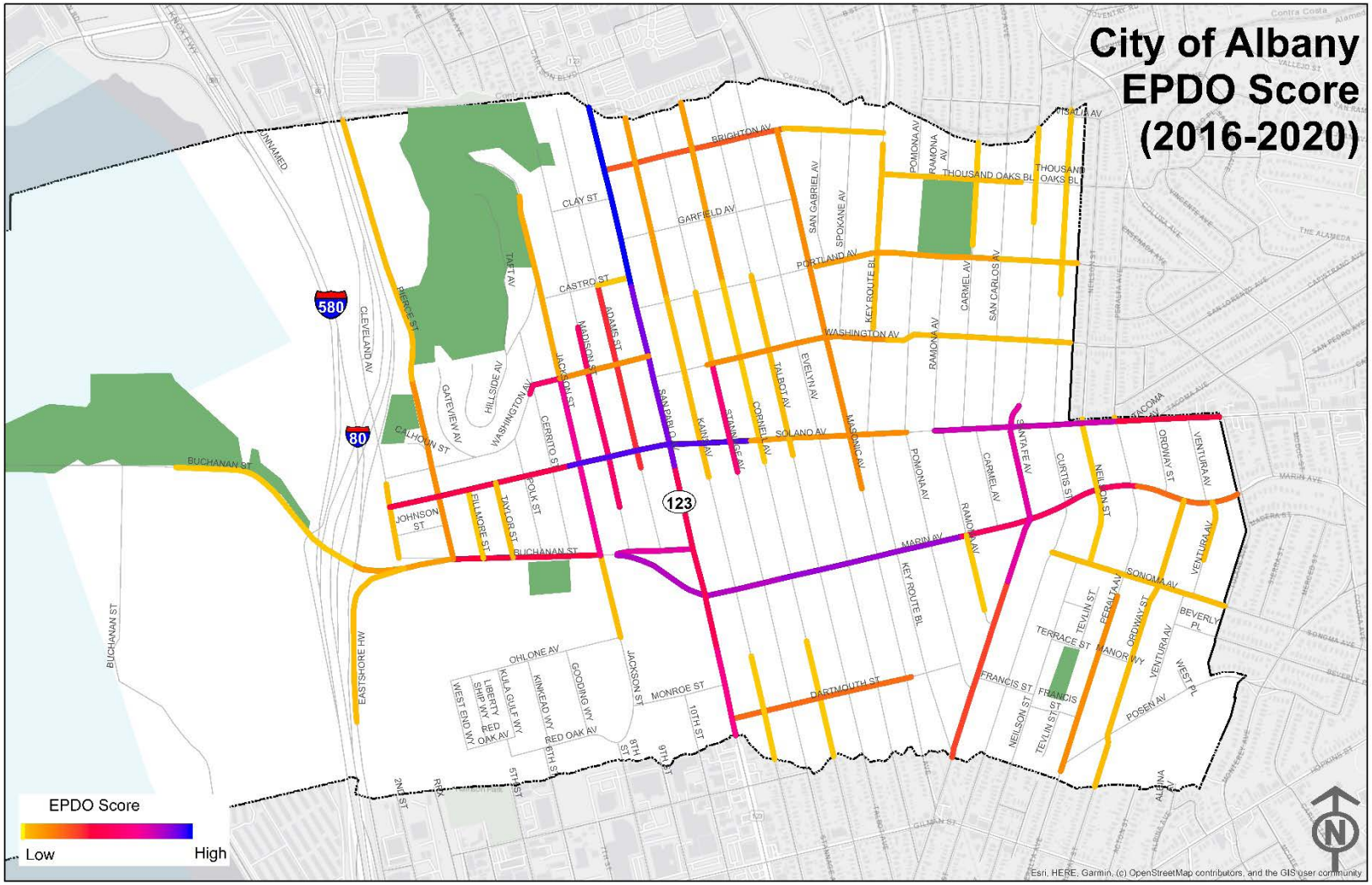
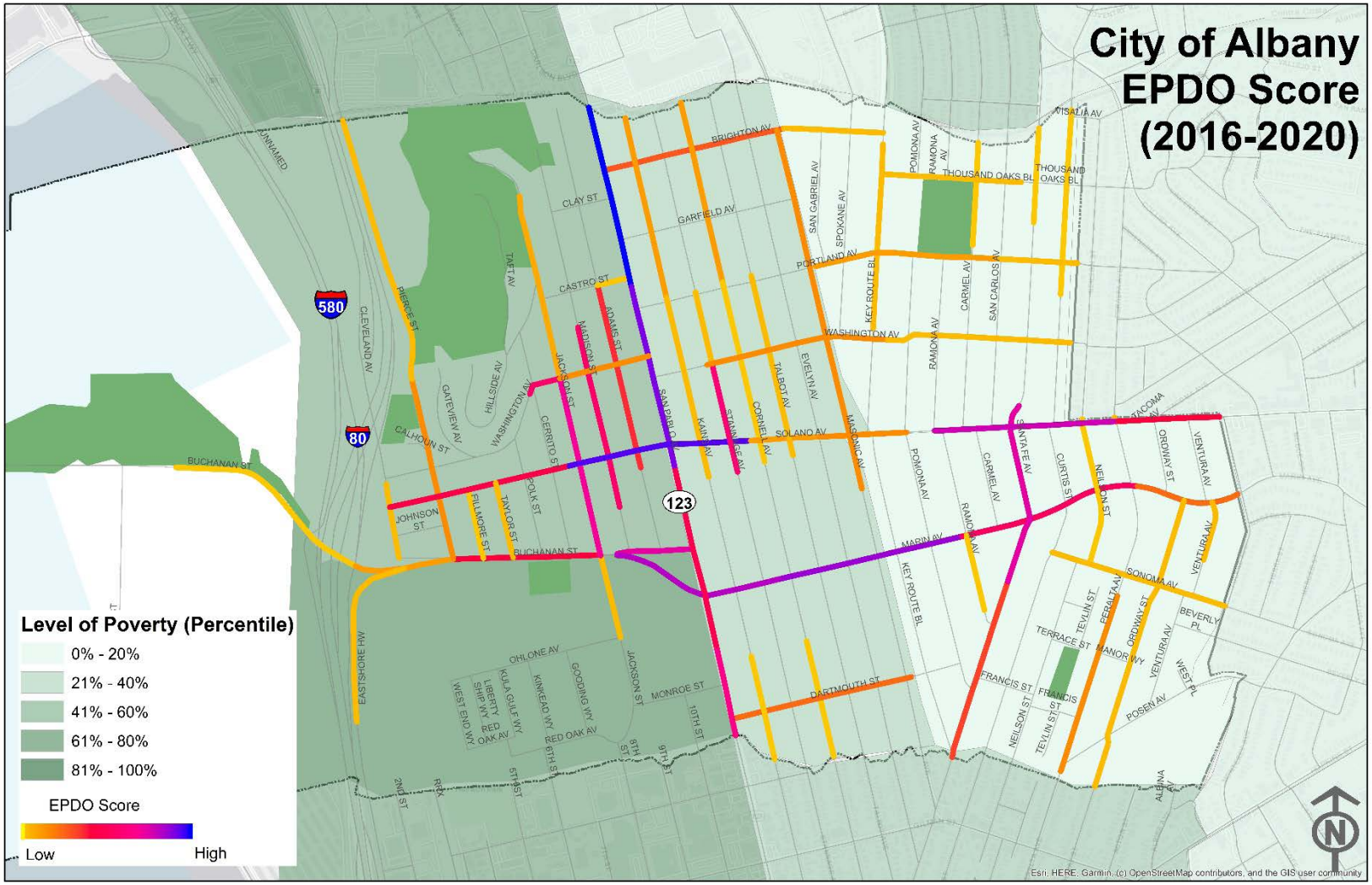


Figure 42. City of Albany Severity Index (with Disadvantaged Communities)



High Injury Network

Following the detailed collision analysis, the next step was to identify the high-injury roadway segments and intersections in City of Albany. The methodology for scoring the high injury locations is the same method as used in the severity weight section. **Figure 43** shows the top seven high-collision roadway segments, and top 10 high-collision intersections. **Figure 44** shows the high injury network overlaid on the Calenviroscreen 4.0 poverty percentile showing disadvantaged communities.

For the purposes of the high collision network analysis, intersections include collisions that occurred within 250 feet of it and roadways include all collisions that occurred along the roadway except for collisions that occurred directly at an intersection. Such collisions are assigned a zero value in distance from intersection value column in the SWITRS.

Figure 43. City of Albany High Injury Network

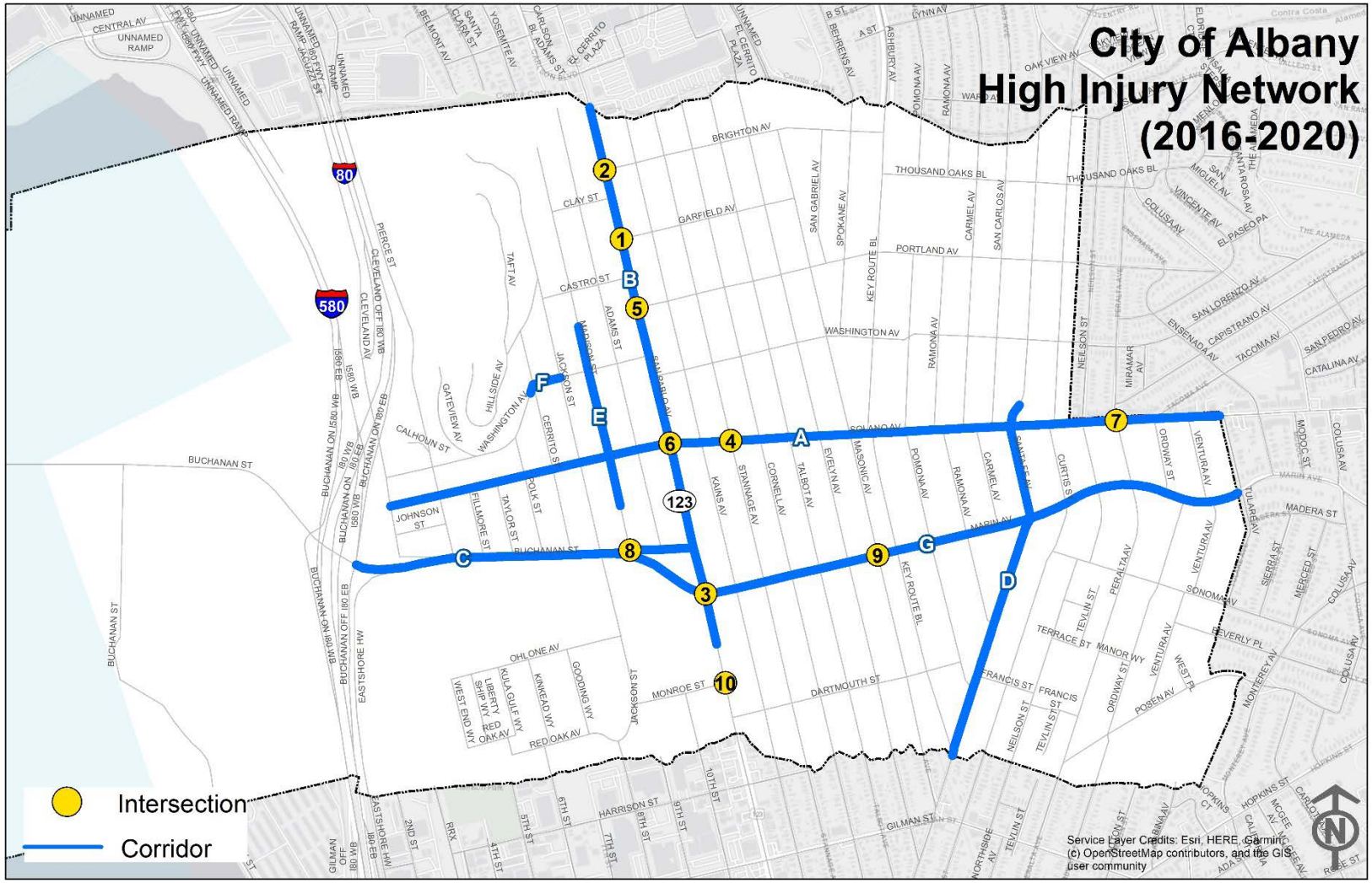
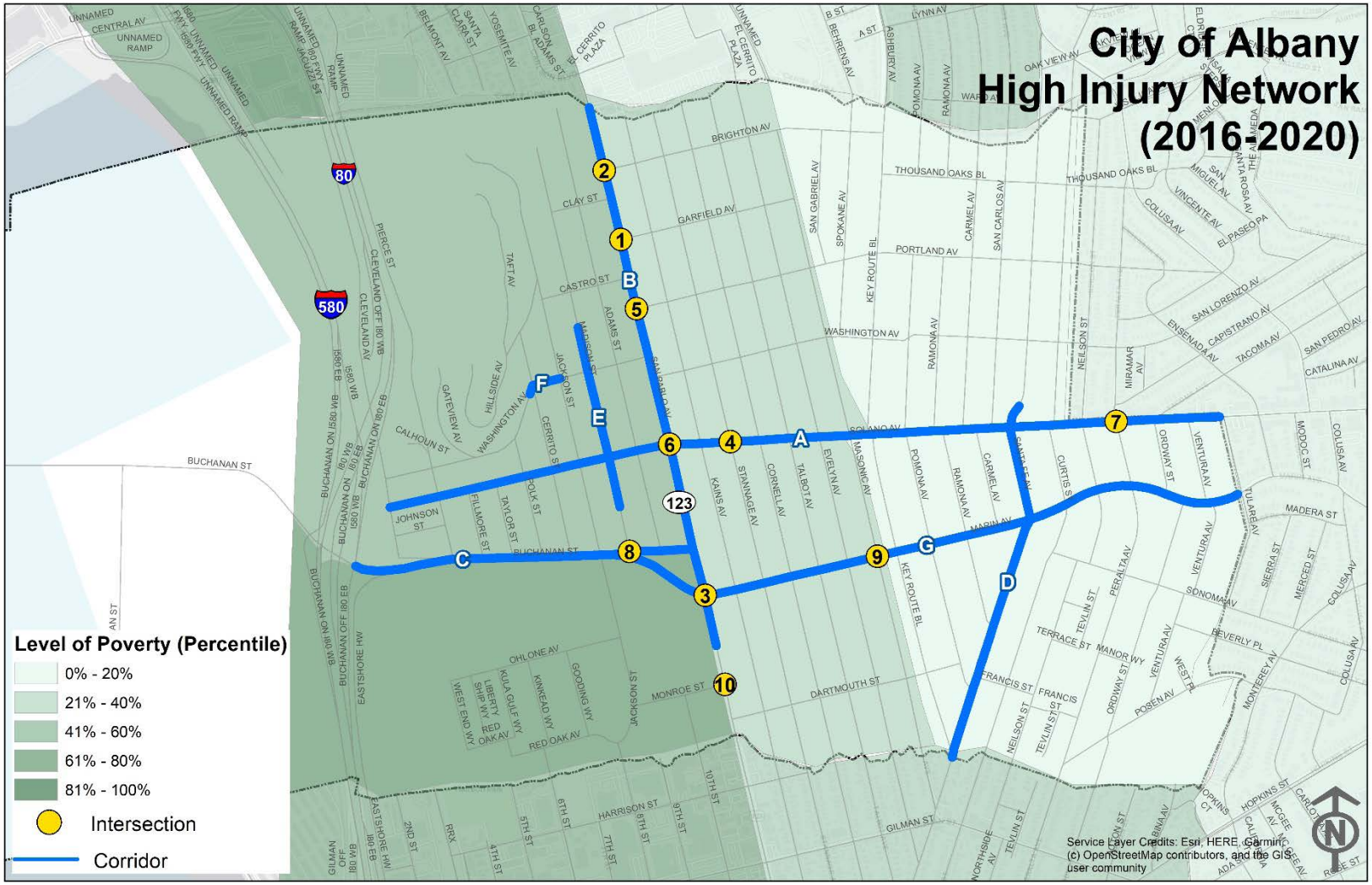


Figure 44. City of Albany High Injury Network (with Disadvantaged Communities)



INTERSECTION RANKING

A total of 10 intersections were identified as high injury intersections. There were a total of 53 injury collisions that occurred at these intersections, including 11 KSI collisions. The intersection of San Pablo Avenue/SR-123 at Garfield Avenue had the most number of KSI collisions with two. Based on the observed collision data, these are the locations in Albany that experienced the most KSI collisions. All 11 KSI collisions that occurred at intersections are represented in this top 10 list. These locations will be further prioritized for improvements in subsequent tasks in the LRSP.

Table 4 lists the EPDO score of the top 10 identified high-collision intersections along with the total number of collisions and the number of KSI collisions that occurred at these locations.

Table 4. High Injury Intersections

ID	Intersection	Total Injury Collisions	KSI Collisions	EPDO Score
1	**San Pablo Ave/SR 123 at Garfield Ave**	9	2	392
2	**San Pablo Ave/SR 123 at Brighton Ave**	13	1	262
3	**San Pablo Ave/SR 123 at Marin St**	7	1	216
4	**Solano Ave at Stannage Ave**	4	1	198
5	**San Pablo Ave/SR 123 at Portland Ave**	4	1	188
6	**San Pablo Ave/SR 123 at Solano Ave**	4	1	188
7	**Solano Ave at Peralta Ave**	3	1	187
8	**Buchanan St at Madison St**	3	1	182
9	**Marin St at Masonic Ave**	3	1	182
10	**San Pablo Ave/SR 123 at Monroe St**	3	1	177

CORRIDOR RANKING

A total of seven corridors were identified as high injury corridors. There were a total 59 injury collisions along these corridors, including seven KSI collisions. The corridor with the highest number of KSI collisions was Solano Avenue between Cleveland Avenue and the City Limit (East) with two. These corridors experienced the most severe crashes among all corridors in Albany, and will be subsequently prioritized in future tasks for improvements.

Table 5 lists the EPDO score of the top seven identified high-collision corridors along with the number of KSI collisions and total collisions.

Table 5. High Injury Corridors

ID	Intersection	Total Injury Collisions	KSI Collisions	Length (mi)	EPDO Score
A	**Solano Ave: Cleveland Ave to City Limit (East)**	14	2	1.4	442
B	**San Pablo Ave/SR 123: City Limit (North) to 450′ S of Marin Ave**	18	1	0.9	312
C	**Buchanan St: I-80 EB Ramps to San Pablo Ave**	8	1	0.6	222
D	**Santa Fe Ave: 200′ N of Solano Ave to City Limit (South)**	5	1	0.6	204
E	**Madison St: 400′ N of Washington St to 450′ S of Solano Ave**	1	1	0.3	165
F	**Washington St: 100′ W of Cerrito Ave to San Pablo Ave**	1	1	0.2	165
G	**Marin St: Buchanan St to City Limit (East)**	12	0	1.0	107

BICYCLE AND PEDESTRIAN HIGH INJURY NETWORK

Utilizing the same scoring methodology as the High Injury Network and EPDO score previously, a high injury network was also developed for only bicycle and pedestrian collisions. **Figure 45** details the location and concentration of EPDO score when considering only bicycle and pedestrian collisions, followed by **Figure 46** which overlays this score onto a map of disadvantaged communities. This is followed by the bicycle/pedestrian high injury network in **Figure 47**. (**Figure 48** shows the high injury network overlaid on the map of disadvantaged communities). All maps include AC Transit stops and routes within Albany to show where greater concentrations of bicycle and pedestrian collisions may be occurring around bus stops. It should be noted that while the higher concentration of bicycle/pedestrian collisions near bus stops may not necessarily mean those pedestrians were walking to a transit connection, it does give a starting point for where pedestrians may be more present. The bicycle/pedestrian high injury network represents the top six intersections and top four roadway segments experiencing more severe bicycle or pedestrian crashes in Albany.

Figure 45. City of Albany Bicycle and Pedestrian EPDO Score

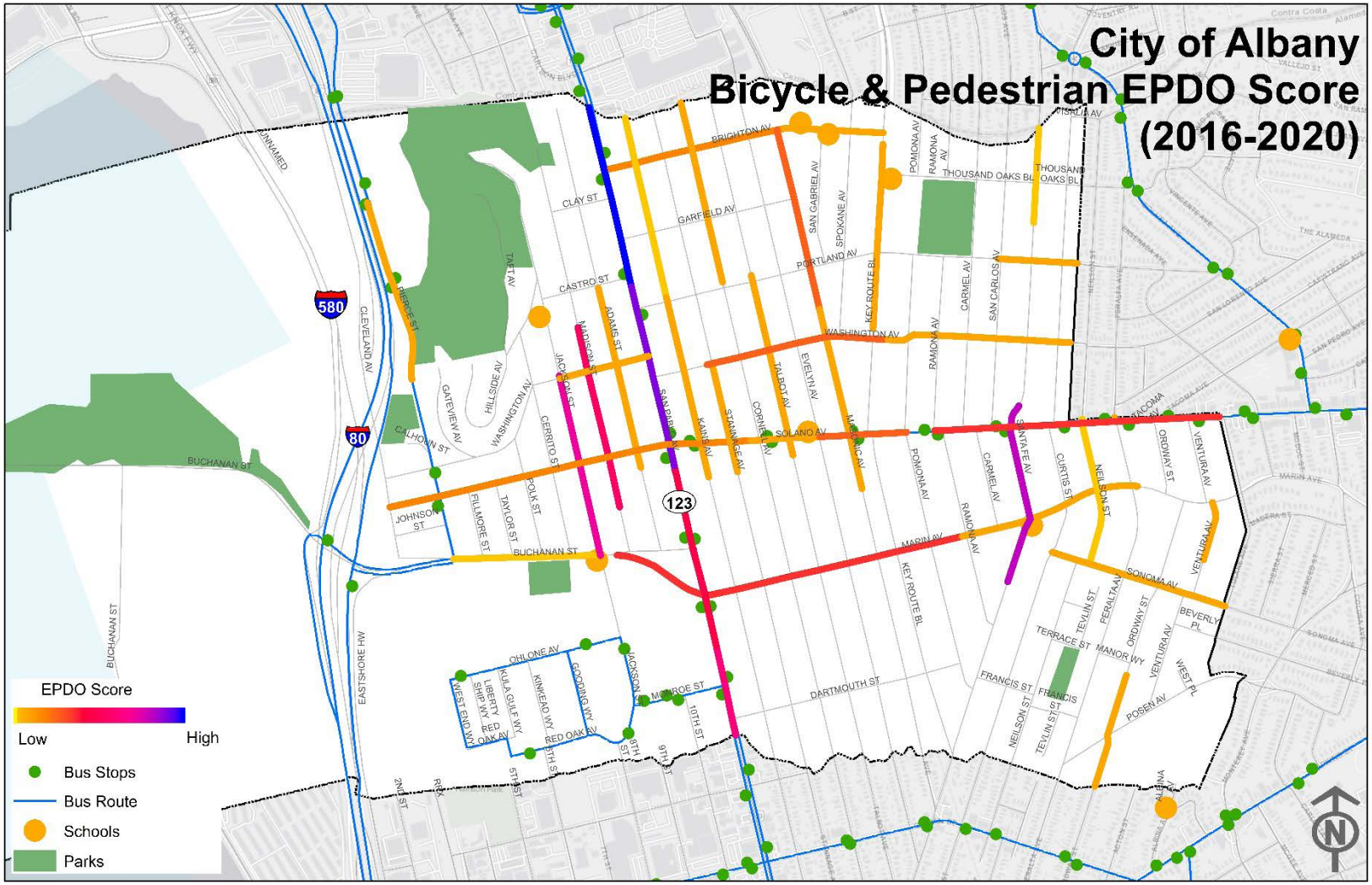


Figure 46. City of Albany Bicycle and Pedestrian EPDO Score (with Disadvantaged Communities)

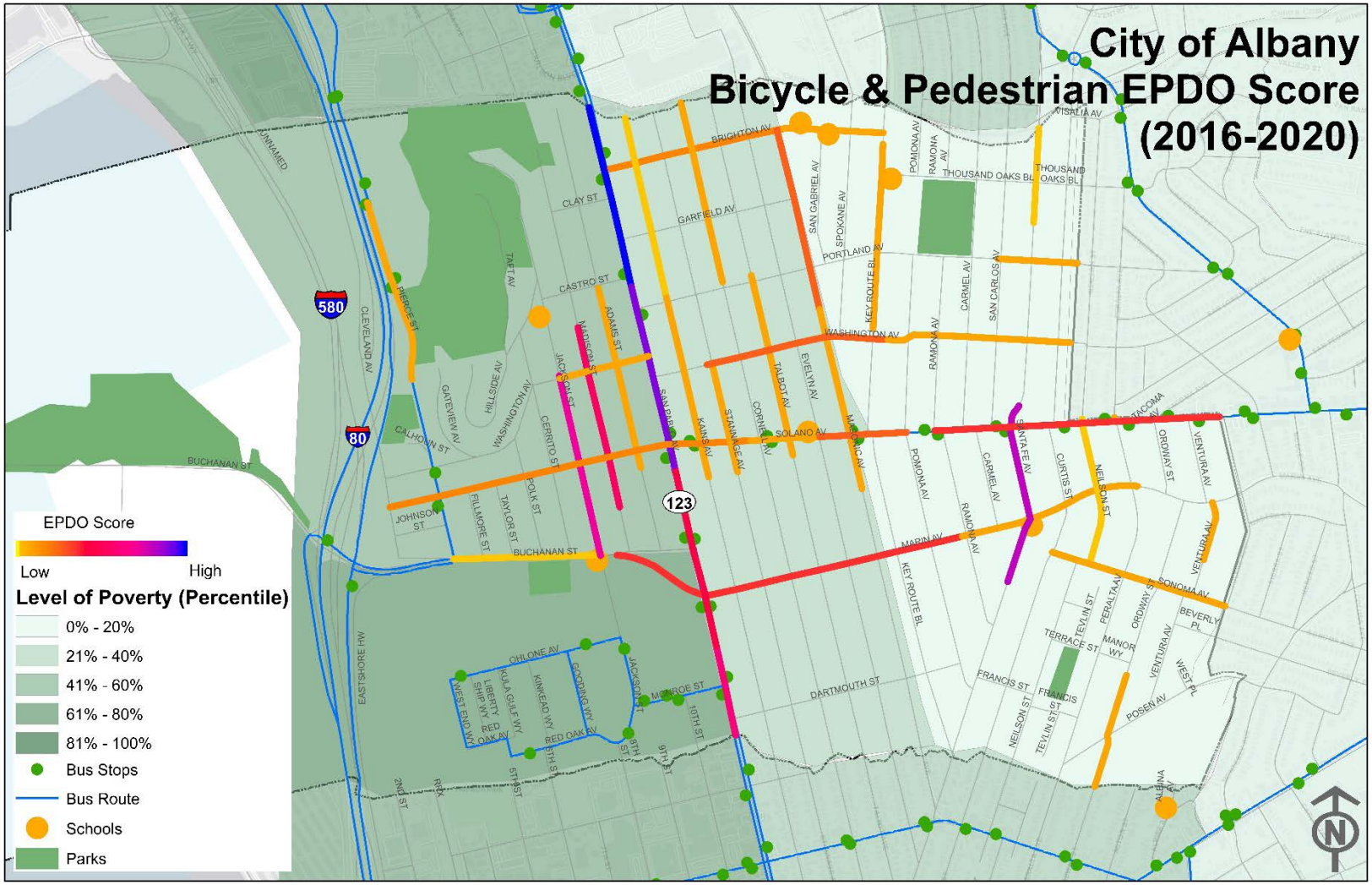


Figure 47. City of Albany Bicycle and Pedestrian High Injury Network

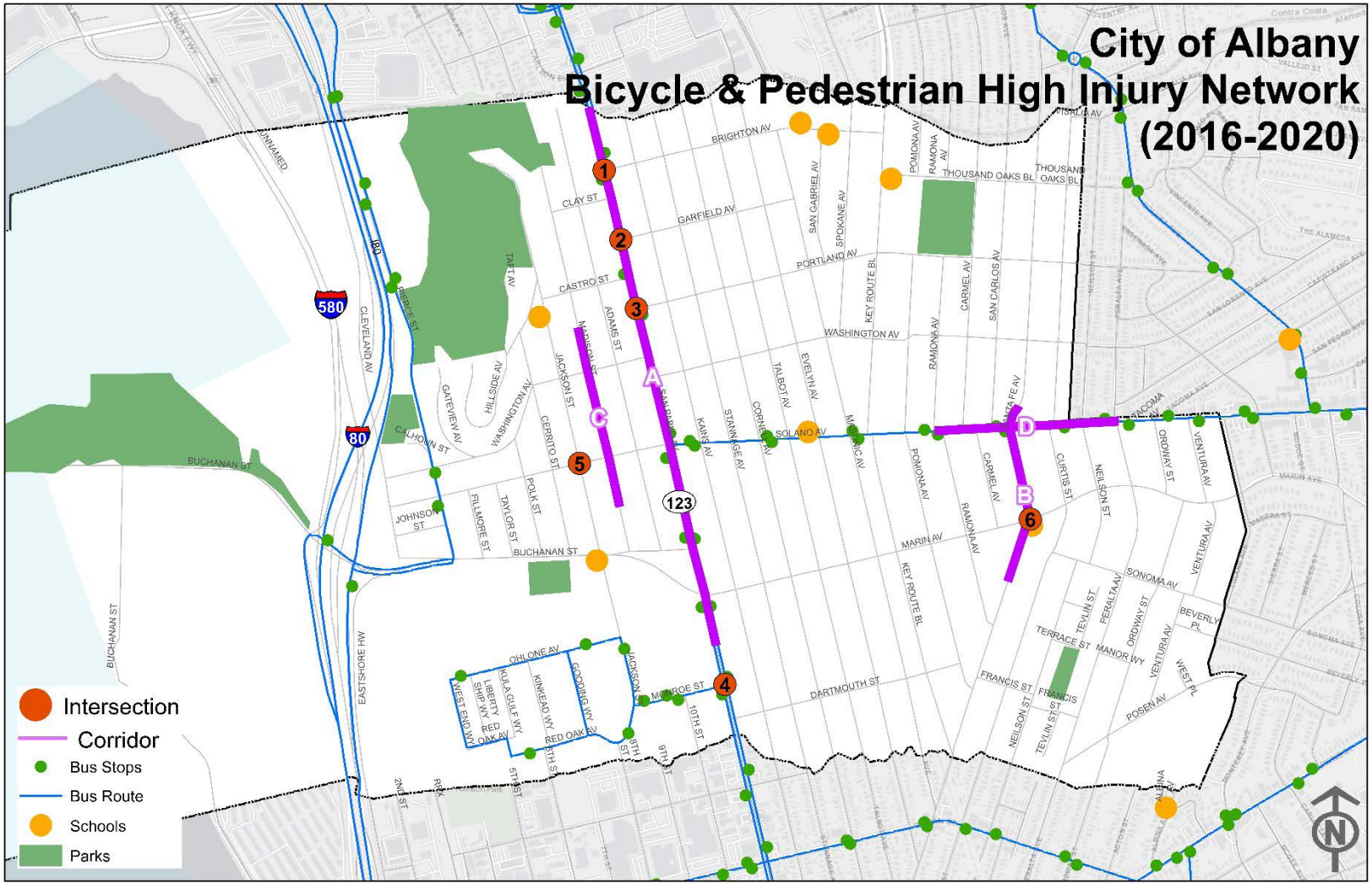
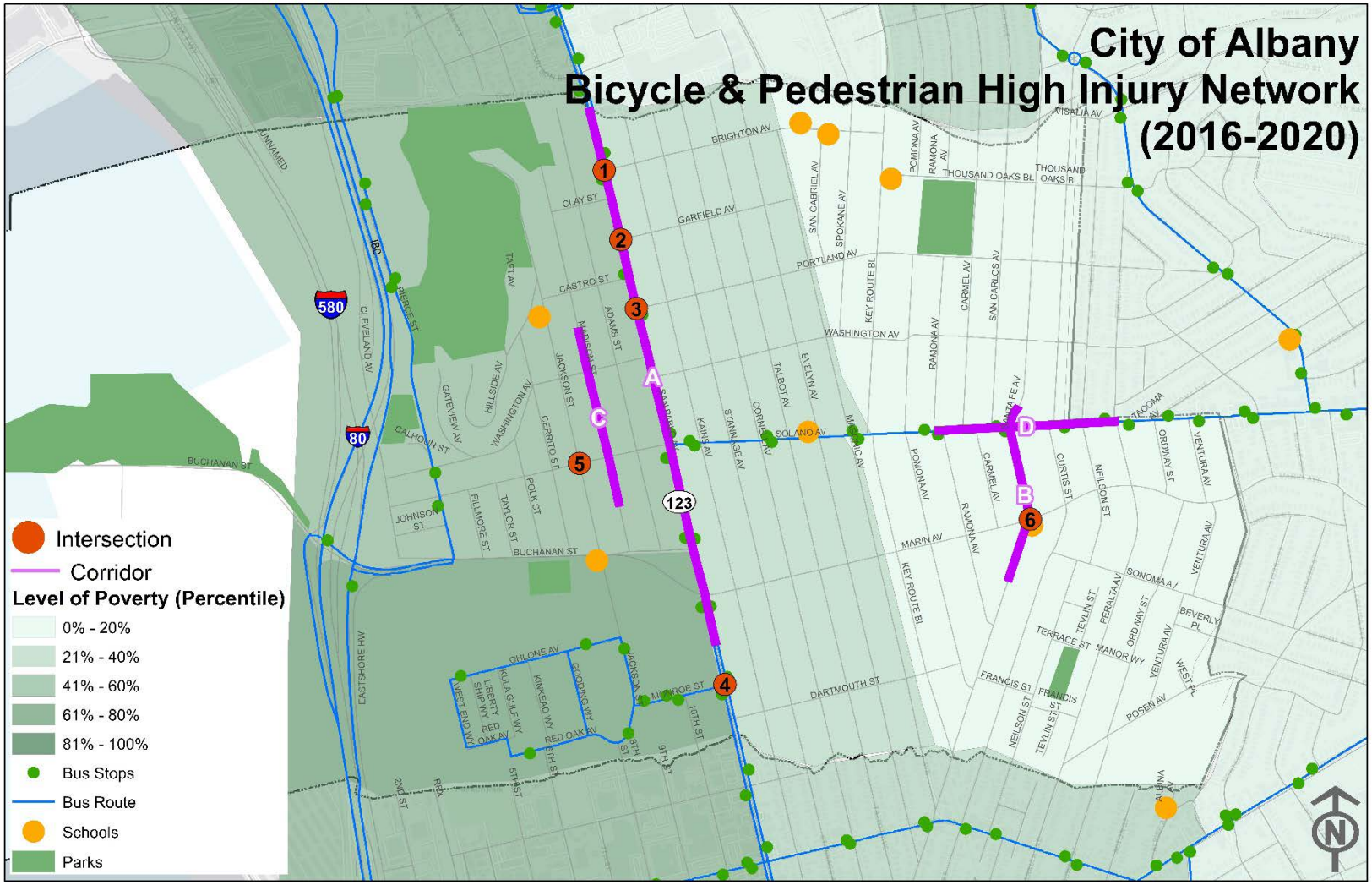


Figure 48. City of Albany Bicycle and Pedestrian High Injury Network (with Disadvantaged Communities)



INTERSECTION AND ROADWAY SEGMENT RANKING

A total of six bicycle and pedestrian high injury intersections were identified. 15 injury collisions occurred at these intersections, including six KSI collisions. San Pablo Avenue/SR 123 at Brighton Avenue had the highest EPDO score. In addition, a total of four corridors were identified as bicycle and pedestrian high injury corridors. There were a total 15 injury collisions along these corridors, including six KSI collisions. The corridor with the highest EPDO score was San Pablo Avenue/SR 123 between the City Limit (North) and 450 feet S of Marin Avenue.

Table 6 lists the EPDO score of the top six identified high-collision intersections along with the number of KSI collisions and total collisions. **Table 7** lists the EPDO score of the top four identified Bicycle and Pedestrian High Injury Corridors along with the KIS collisions and total collisions.

Table 6. Bicycle and Pedestrian High Injury Intersections

ID	Intersection	Total Injury Collisions	KSI Collisions	EPDO Score
1	San Pablo Ave/SR 123 at Brighton Ave	7	1	216
2	San Pablo Ave/SR 123 at Garfield Ave	2	1	176
3	San Pablo Ave/SR 123 at Portland Ave	2	1	176
4	San Pablo Ave/SR 123 at Monroe Ave	2	1	171
5	Solano Ave at Jackson St	1	1	165
6	Marin St at Santa Fe Ave	1	1	165

Table 7. Bicycle and Pedestrian High Injury Corridors

ID	Intersection	Total Injury Collisions	KSI Collisions	Length (mi)	EPDO Score
A	San Pablo Ave/SR 123: City Limit (North) to 450′ S of Marin Ave	9	1	0.9	238
B	Santa Fe Ave: 200′ N of Solano Ave to 550′ S of Marin Ave	3	1	0.3	182
C	Madison St: 400′ N of Washington St to 450′ S of Solano Ave	1	1	0.3	165
D	Solano Ave: Ramona Ave to Peralta Ave	2	0	0.3	17

Summary

During the study period of 2016-2020, a total of 478 collisions occurred on Albany roads, of which 16 resulted in either a fatality or severe injury. The number of collisions occurring each year has been overall decreasing, with the most occurring in 2016 (the most KSI collisions occurred in 2018). A majority of collisions occurred at intersections not along roadway segments. Based on the collision data, five prominent trends emerged: broadside collisions, improper turning, pedestrian collisions, bicycle collisions, and rear end collisions. Each of these were selected because they were prominent factors in causing collisions on the City's roadways, with a particular emphasis on KSI collisions. A more detailed geographic analysis was conducted for each of the five identified trends.

Broadside Collisions: For KSI collisions in Albany, 25% of collisions were broadside collisions. This is slightly higher than its share of collisions of all severity (22%). Broadside collisions can potentially be mitigated by increasing the visibility of an intersection through updated pavement markings, new or updated signage, lighting, advance flashing beacons, and improving sight distance.

Improper Turning Collisions: For KSI collisions in the city of Albany, 13% of collisions occurred due to improper turning violation, the most of any category. It also contributed to 19% of all collisions. Countermeasures such as improving sight distance at intersections, installing dedicated left turn lanes, median splitter islands on minor road approaches, and raised medians can help to mitigate improper turning caused collisions.

Pedestrian Collisions: 25% of KSI collisions in Albany involved a pedestrian, compared to just 8% of collisions of all severity. Countermeasures such as traffic calming, high visibility crosswalks, RRFBs, sidewalk bulb outs, advanced flashing warning signs, can all help to address pedestrian collisions.

Bicycle Collisions: 19% of KSI collisions in Albany involved a bicycle, compared to 8% of collisions of all severity. These collisions can potentially be mitigated with enhanced bicycle infrastructure, such as protected bike lanes, bicycle boxes at signalized intersections, green paint for enhanced visibility, additional lighting, or adding bike lanes/widening shoulders.

Rear End Collisions: 26% of collisions of all severity were rear end collisions, the most of all collision types. It also makes up 6% of KSI collisions. Rear end collisions can potentially be mitigated through upgrading signal hardware or adding retroreflective borders, improving signal timing, upgrading/adding intersection warning signs, or adding flashing beacons in advance of intersections. Methods to reduce speeding, such as traffic calming, can also help to address rear end collisions.

The Emphasis Areas identified are based on the collision analysis presented in this report. The most prominent collision types, violations, and human behaviors have been selected for inclusion as an Emphasis Area, as these represent the most prominent traffic safety issues in Albany. Each Emphasis Area is accompanied with strategies corresponding to the 5 E's of safety to comprehensively make the City of Albany safer for all modes of transportation.

5 | EMPHASIS AREAS

5 EMPHASIS AREAS

Emphasis areas are focus areas for the LRSP that are identified through the comprehensive collision analysis of the identified high injury locations within Albany. Emphasis areas help in identifying appropriate safety strategies and countermeasures with the greatest potential to reduce collisions occurring at these high injury locations. They can include (but not be limited to): specific collision types, human behaviors, facility types, and specific locations or corridors.

This section summarizes the top seven emphasis areas identified for Albany. These emphasis areas were derived from the consolidated high injury collision database (**Appendix A**) where top injury factors were identified by combing the data manually. The high injury collision database contains only collisions occurring at the high injury intersections or along the high injury corridors. Along with findings from the data analysis, stakeholder input was to refine the emphasis areas specific to Albany.

The following are the identified emphasis areas –

- Improve Safety at Signalized Intersections (Collisions within 250 feet of an intersection)
- Address Broadside Collisions and Automobile Right of Way Violations
- Improve Rear End Collisions
- Address Improper Turning Collisions
- Address Bicycle Safety
- Address Pedestrian Safety
- Improve San Pablo Avenue (Intersection and Roadway Segment)

The 5 E's of Traffic Safety

The LRSP utilizes a comprehensive approach to safety incorporating "5 E's of traffic safety": **E**ngineering, **E**nforcement, **E**ducation, **E**quity, and **E**mergency Medical Services (EMS.) This approach recognizes that not all locations can be addressed solely by infrastructure improvements. Incorporating the 5 E's of traffic safety is often required to ensure successful implementation of significant safety improvements and reduce the severity and frequency of collisions throughout a jurisdiction.

Some of the common violation types that may require a comprehensive approach are speeding, failure-to-yield to pedestrians, red light running, aggressive driving, failure to wear safety belts, distracted driving, and driving while impaired. When locations are identified as having these types of violations, coordination with the appropriate law enforcement agencies is needed to arrange visible targeted enforcement to reduce the potential for future driving violations and related crashes and injuries.

To improve safety, education efforts can be used to supplement enforcement and improve the efficiency of each strategy. Education can also be employed in the short-term to address high crash locations until the recommended infrastructure project can be implemented. Similarly, EMS entails strategies around supporting organizations that provide rapid response and care when responding to collisions causing injury, by stabilizing victims and transporting them to facilities. Equity refers to examining the impact collisions have on disadvantaged communities and allocating resources to address them.

Existing Traffic Safety Efforts in Albany

The City of Albany and partner agencies have already implemented safety strategies corresponding to the 5 E's of traffic safety. The strategies detailed in this chapter can supplement these existing programs and concentrate them on high injury collision locations and crash types. These initiatives are summarized in the following table:

Table 8. Existing Programs Summary

Document/ Program	Description	E's Addressed
Albany Traffic Calming Policy & Traffic Management Plan	The City of Albany Traffic Calming Policy establishes the process for requesting roadway elements that encourage slower vehicular traffic speeds on a particular street block or street segment.	Enforcement & Engineering
Albany Active Transportation Plan	The Albany Active Transportation Plan (ATP) assesses unmet needs for non-motorized transportation in the city and sets key goals and policy objectives. It recommends citywide bicycle routes, safe routes to school strategies, traffic calming, expanding the network of off-street paths, and safety improvements.	Engineering & Education
Solano Complete Streets	The City of Albany developed a Complete Streets and Corridor Revitalization Plan for Solano Avenue from Masonic Avenue to Tulare Avenue to create an active main street environment. The outcome will be a plan with Complete Streets designs for roadway, sidewalk and intersection changes that support all modes and users of all ages and abilities, builds foot traffic for local businesses, encourages interaction in public spaces, and adds vibrancy to the community.	Engineering
Complete Streets (Buchanan & San Pablo)	The City of Albany, in partnership with the Local Government Commission, explored ways to make it easier and safer to walk, bike, ride the bus, and drive along San Pablo Avenue and Buchanan Street.	Engineering
Safe Routes to School	The Alameda County Safe Routes to Schools (SRTS) Program organizes and supports fun, educational activities that encourage families to walk, bike, carpool, and take transit to school. The City of Albany also supplements this program with funding for in-school bicycle education programs.	Education
Albany Police Department	The Albany Police Department is responsible for the preservation of public peace, enforcement of laws, protection of life and property, and providing police related services to the community. The APD also conducts bicycle/ pedestrian outreach and safety campaigns.	Enforcement, EMS, Education
Albany Fire Department	The Albany Fire Department is a full-service department providing the community with many diverse services including fire protection, emergency and disaster response, paramedic services, community education, earthquake preparedness and special events.	Enforcement, EMS

Factors Considered in the Determination of Emphasis Areas

This section presents collision data analysis of collision type, collision factors, facility type, roadway geometries, and party level data, analyzed for the various emphasized areas. Emphasis areas were determined by factors that led to the highest amount of injury collisions, with a specific emphasis on KSI collisions. Albany experienced a total of 88 collisions at high injury network locations during the 2016-2020 study period, including 16 KSI collisions. The data presented below in each emphasis area is based on these collisions. Emphasis areas were further refined by stakeholder and community input.

Each emphasis area is accompanied by comprehensive programs, policies and countermeasures to reduce collisions on City roads in that specific emphasis area. It will provide the basis by which the countermeasure toolbox is developed for each identified high-injury location.

EMPHASIS AREA 1 – IMPROVE SAFETY AT NON-SIGNALIZED INTERSECTIONS

Non-Signalized Intersection collisions comprised 75% of collisions of all severity, as well as 69% of KSI collisions. Six of 11 KSI collisions on the High Injury Network occurred at non-signalized intersections. The following collision data is based on the High Injury Network of non-signalized intersections collisions of the City of Albany, followed by E's strategies selected to address intersection collisions.

34% (17 collisions) Rear End Collisions

32% (16 collisions) Due to Unsafe Speed

36% (18 collisions) Involved Bicycle or Pedestrian

Table 9. Emphasis Area 1 Strategies

Objective: Reduce the number of KSI collisions at non-signalized intersections.			
	Strategy	**Performance Measure**	**Agencies/ Organizations**
Education	Conduct public information and education campaign for intersection safety laws regarding, stop signs, and turning left or right.	Number of education campaigns or residents reached.	City/Police Department
Enforcement	Targeted enforcement at high-injury intersections to monitor right-of-way violations, speed limit laws and other violations that occur at non-signalized intersections.	Decrease in number of citations and/or warnings issued over time due to increased driver compliance.	Police Department
Engineering	• NS01, Install intersection lighting • NS02, Convert to all-way STOP control (from 2-way or Yield control) • NS03, Install signals • NS04/NS05, Convert intersection to roundabout • NS05mr, Convert intersection to mini-roundabout • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings • NS08, Install Flashing Beacons at Stop-Controlled Intersections • NS09, Install flashing beacons as advance warning • NS11, Improve sight distance to intersection (Clear Sight Triangles) • NS13, Install splitter-islands on the minor road approaches • NS14, Install raised median on approaches • NS15, Create directional median openings to allow (and restrict) left turns and U-turns • NS21PB, Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features) • NS22PB, Install RRFB	Number of intersections improved.	City
EMS	S05, Install emergency vehicle pre-emption systems Improve radio frequency or GPS signal for emergency responses to collision sites. Ensure emergency routes are clear and well defined.	EMS vehicle response time.	City/Fire Department & EMS Response Teams

EMPHASIS AREA 2 – ADDRESS BROADSIDE COLLISIONS AND AUTOMOBILE RIGHT OF WAY VIOLATIONS

14 (16%) of the high injury network collisions were broadside collisions, including four KSI collisions. 13% (11 collisions) of high injury network collisions were caused by an automobile right of way violation (which also caused 36% of broadside collisions). These two are combined due to the correlation between automobile right of way violations and broadside collisions. The following collision data is based on only broadside injury collisions on the high injury network of Albany, followed by E's strategies to address them.

29% (4 collisions) KSI Collisions

93% (13 collisions) Occurred at Intersections

43% (6 collisions) Occurred on San Pablo Ave

Table 10. Emphasis Area 2 Strategies

Objective: Reduce the number of KSI broadside collisions and automobile right of way violations.			
	Strategy	**Performance Measure**	**Agencies/ Organizations**
Education	Conduct public information and education campaigns for intersection safety laws regarding traffic lights, stop signs and turning left or right and right of way.	Number of education campaigns or residents reached.	City/Police Department
Enforcement	Targeted enforcement at high-injury locations where violations that lead to broadside collisions are more common, such as automobile right of way and traffic signal/stop sign violations.	Decrease in number of citations and/or warnings issued over time due to increased driver compliance.	Police Department
Engineering	• S01/NS01/R01, Add intersection or segment lighting • S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number • S03, Improve signal timing • S08, Convert signal to mast arm (from pedestal-mounted) • S09, Install raised pavement markers and striping • S16/NS04/NS05, Convert intersection to roundabout • NS02, Convert to all-way STOP control (from 2-way or Yield control) • NS03, Install signals • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • NS08, Install flashing beacons at stop controlled intersections • NS09/S10, Install flashing beacons as advance warning • NS11, Improve sight distance to intersection (Clear Sight Triangles) • NS13, add splitter-islands on the minor road approaches • S12/NS14, install raised median on approaches	Number of locations improved to mitigate broadside collisions.	City
EMS	S05, Install emergency vehicle pre-emption systems Improve resource of deployment for emergency responses to collision sites. Ensure emergency routes are clear and well defined	EMS vehicle response time.	City/Fire Department & EMS Response Teams

EMPHASIS AREA 3 – ADDRESS REAR END COLLISIONS AND UNSAFE SPEED VIOLATIONS

25 (28%) of collisions on the high injury network were rear end collisions, including one (7%) KSI collisions. 25% of high injury collisions were caused by unsafe speed, and also caused the majority of rear end collisions. Rear end collisions constituted the most prominent collision type among the high injury network collisions. The following collision data is based on only rear end collisions on the high injury network of Albany, followed by E's strategies selected to address rear end collisions.

84% (21 collisions) Involved Other Motor Vehicle

36% (9 collisions) Occurred on Marin Ave

76% (19 collisions) Occurred due to Unsafe Speed Violation

Table 11. Emphasis Area 3 Strategies

Objective: Reduce the number of KSI rear end collisions.			
	Strategy	**Performance Measure**	**Agencies/ Organizations**
Education	Conduct public information and education campaign for safety laws regarding unsafe speed, following too closely and its dangers.	Number of education campaigns or residents reached.	City/Police Department
Enforcement	Targeted enforcement at high-injury locations where unsafe speed violations are more common.	Decrease in number of citations and/or warnings issued over time due to increased driver compliance.	Police Department
Engineering	• S01/NS01/R01, Add intersection or segment lighting • S02, Improve signal hardware • S03, Improve signal timing • S04, Provide Advanced Dilemma-Zone Detection for high speed approaches • S06/NS18, Install left turn lane • S09, Install raised pavement markers and striping (Through Intersection) • S11/NS12/R21, Improve pavement friction (High Friction Surface Treatment) • S16/NS04/NS05, Convert intersection to roundabout • NS06, Install/upgrade larger or additional intersection signs • NS07, Upgrade intersection pavement markings (NS.I.) • R14, Road Diet • R22, Install/Upgrade signs with new fluorescent sheeting • R26, Install dynamic/variable speed warning signs • R28, Install edge-lines and centerlines • Decrease width of travel lanes and traffic calming strategies where appropriate • Simplify turn configurations and decrease curb radius of intersections	Number of locations improved.	City
EMS	S05, Install emergency vehicle pre-emption systems Improve resource of deployment for emergency responses to collision sites. Ensure emergency routes are clear and well defined	EMS vehicle response time.	City/Fire Department & EMS Response Teams

EMPHASIS AREA 4 – ADDRESS IMPROPER TURNING VIOLATIONS

Nine (10%) of high injury network collisions occurred due to improper turning violations, including two (13%) KSI collisions. It also made up 19% of all collisions citywide. The following collision data is based on only improper turning violations on the high injury network of Albany, followed by E's strategies selected to address improper turning violations.

44% (4 collisions) Involved another motor vehicle

33% (3 collisions) Occurred Not at Intersection

78% (7 collisions) Occurred on San Pablo Ave

Table 12. Emphasis Area 4 Strategies

Objective: Reduce the number of KSI collisions that occur due to improper turning violations.			
	Strategy	**Performance Measure**	**Agencies/ Organizations**
Education	Conduct public information and education campaign for intersection safety laws and the rules of the road.	Number of education campaigns or residents reached.	City/Police Department
Enforcement	Targeted enforcement at high-injury locations where improper turning violations are more common.	Decrease in number of citations and/or warnings issued over time due to increased driver compliance.	Police Department
Engineering	• S01/NS01/R01, Add Lighting • S02, Improve signal hardware • S03, Improve signal timing (coordination, phases, red, yellow, or operation) • S09, Install raised pavement markers and striping (Through Intersection) • S12/NS14, Install raised median on approach • S14, Create directional median openings to allow (and restrict) turns • S16/NS04/NS05, Convert intersection to roundabout • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs • NS07, Upgrade intersection pavement markings (NS.I.) • NS13, Install splitter islands on minor road approaches • R22, Install/Upgrade signs with new fluorescent sheeting • R27, Install delineators, reflectors and/or object markers • R26, Install dynamic/variable speed warning signs • R28, Install edge-lines and centerlines	Number of locations improved.	City
EMS	S05, Install emergency vehicle pre-emption systems Improve resource of deployment for emergency responses to collision sites Ensure emergency routes are clear and well defined	EMS vehicle response time.	City/ Fire Department & EMS Response Teams

EMPHASIS AREA 5 – ADDRESS BICYCLE SAFETY

16 (18%) of collisions on the high injury network involved bicyclists, however, of these 16 collisions, three were severe injury collisions. Majority of the bicycle collisions (including most severe injury) occurred along the San Pablo Road running through of the City. The following collision data is based on only bicycle collisions on the high injury network of Albany, followed by 4 E's strategies to address them.

20% (3 collisions) KSI Collisions

31% (5 collisions) Occurred due to Automobile Right-of-Way Violation

50% (8 collisions) Occurred at on San Pablo Ave

Table 13. Emphasis Area 5 Strategies

Objective: Reduce the number of KSI collisions involving bicyclists.			
	Strategy	**Performance Measure**	**Agencies/ Organizations**
Education	Conduct bicycle safety campaigns and outreach to raise their awareness of bicycle safety needs through media outlets, social media, and public events. Partner with Safe Routes to School to conduct bicycle and pedestrian safety programs in Albany's schools.	Number of education campaigns or residents reached.	City/School District/ Police Department
Enforcement	Targeted enforcement at high-injury locations especially near schools, trails, and other areas where bicyclists are more present. Continue to place a high priority on enforcement of motorist and bicyclist violations that most frequently cause injuries and fatalities among bicyclists.	Decrease in number of citations and/ or warnings issued over time due to increased driver compliance.	Police Department
Engineering	• S01/NS01/R01, Add intersection or segment lighting • S17PB, Install pedestrian countdown signal heads • S20PB, Install advance stop bar before crosswalk (Bicycle Box) • S21PB, Modify signal phasing to implement a LPI • NS19PB, Install raised medians (refuge islands) • NS21PB/R35PB, Install/upgrade pedestrian crossing (with enhanced safety features) • NS22PB/R37PB, Install RRFB • NS23PB, Install pedestrian signal (including Pedestrian Hybrid Beacon (HAWK)) • R14, Road diet (reduce travel lanes from 4 to 3 and add a two-way left turn lane and bike lanes) • R32PB, Install bike lanes • R33PB, Install separated bike lanes • R34PB, Install sidewalk/pathway (to avoid walking along roadway) • Mid-block curb extension • Intersection bulb-outs	Number of locations improved.	City
EMS	S05, Install emergency vehicle pre-emption systems Improve resource of deployment for emergency responses to collision sites Ensure emergency routes are clear and well defined, particularly to areas and times of high bicycle activity	EMS vehicle response time.	City/ Fire Department & EMS Response Teams

EMPHASIS AREA 6 – ADDRESS PEDESTRIAN SAFETY

20 (23%) of collisions on the high injury network involved pedestrians, out of which three were KSI collisions. The majority of the pedestrian collisions (including two out of three KSI collisions) occurred along the San Pablo Avenue. The following collision data is based on only pedestrian collisions on the high injury network of Albany, followed by E's strategies to address them.

35% (7 collisions) Occurred at Night

20% (5 collisions) Occurred due to Pedestrian Violation

45% (9 collisions) Occurred due to Pedestrian Right-of-Way Violation

Table 14. Emphasis Area 6 Strategies

Objective: Reduce the number of fatal and severe injury collisions involving pedestrians.			
	Strategy	**Performance Measure**	**Agencies/ Organizations**
Education	Conduct pedestrian safety campaigns and outreach to raise their awareness of pedestrian safety needs through media outlets, social media, and public events. Partner with Safe Routes to School to conduct bicycle and pedestrian safety programs in Albany's schools.	Number of education campaigns or residents reached.	City/School District/ Police Department
Enforcement	Targeted enforcement at high-injury locations especially near schools, trails, and other areas where pedestrians are more present. Continue to place a high priority on enforcement of motorist and pedestrian violations that most frequently cause injuries and fatalities among pedestrians.	Decrease in number of citations and/or warnings issued over time due to increased driver compliance.	Police Department
Engineering	• S01/NS01/R01, Add intersection or segment lighting • S13PB/R10PB, Install pedestrian median fencing • S17PB, Install pedestrian countdown signal heads • S18PB, Install pedestrian crossing (S.I.) • S19PB, Pedestrian Scramble • S20PB, Install advance stop bar before crosswalk (Bicycle Box) • S21PB, Modify signal phasing to implement a LPI • NS11, Improve sight distance to intersection • NS19PB, Install raised medians (refuge islands) • NS21PB/R35PB, Install/upgrade pedestrian crossing (with enhanced safety features) • NS22PB, Install RRFB • NS23PB, Install pedestrian signal (including Pedestrian Hybrid Beacon (HAWK)) • R34PB, Install sidewalk/pathway (to avoid walking along roadway) • R36PB, Install raised pedestrian crossing • R37PB, Install RRFB • High-visibility triple four crosswalks • Mid-block curb extension and intersection bulb-outs • In-road yield sign for pedestrian crossing at crosswalk	Number of locations improved.	City
EMS	S05, Install emergency vehicle pre-emption systems Improve resource of deployment for emergency responses to collision sites Ensure emergency routes are clear and well defined, particularly to areas and times of high pedestrian activity	EMS vehicle response time.	City/Fire Department & EMS Response Teams

EMPHASIS AREA 7 – IMPROVE SAN PABLO AVENUE (INTERSECTIONS AND ROADWAY SEGMENTS)

A total of 38 (43%) of high injury network collisions occurred along San Pablo Avenue, including six KSI collisions (40%). San Pablo Avenue was selected as an emphasis area due to the high percentage of collisions, combined with the fact that San Pablo Avenue is an important arterial. The following collision data is based on only San Pablo Avenue collisions on the high injury network of Albany, followed by E's strategies selected to address DUI collisions.

50% (19 collisions) Involved Pedestrian or Bicycle

29% Occurred at Night or Dawn/Dusk

21% (8 collisions) Rear-End Collisions

Table 15. Emphasis Area 7 Strategies

Objective: Reduce the number of KSI collisions on San Pablo Avenue.			
	Strategy	**Performance Measure**	**Agencies/ Organizations**
Education	Conduct public information and education campaigns on risks of improper driving behaviors occurring on San Pablo Ave, such as unsafe speed and improper turning.	Number of education campaigns	City/Police Department
Enforcement	Targeted enforcement at high-injury intersections and roadway locations on San Pablo Ave to monitor violations of driving under influence.	Decrease in number of citations and/ or warnings issued over time due to increased driver compliance.	Police Department
Engineering	• S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number • S03, Improve signal timing • S09, Install raised pavement markers • S11/NS12/R21, Improve pavement friction • NS06, Install/upgrade larger or additional stop/warning/ regulatory signs • NS07, Upgrade intersection pavement markings • NS11, Improve sight distance to intersection (Clear Sight Triangles) • NS13, Install splitter-islands on the minor road approaches • NS19PB, Install raised medians (refuge islands) • NS22PB/R37PB, Install RRFB • NS23PB, Install pedestrian signal (Including HAWK signal) • R22, Install/Upgrade signs with new fluorescent sheeting • R27, Install delineators, reflectors, and/or object markers • R33PB, Install separated bike lanes • Speed warning signs	Number of locations improved.	City
EMS	S05, Install emergency vehicle pre-emption systems Improve resource of deployment for emergency responses to collision sites. Ensure emergency routes are clear and well defined	EMS vehicle response time.	Fire Department & EMS Response Teams

6 | COUNTERMEASURE SELECTION

6 COUNTERMEASURE SELECTION

Identification of Countermeasures

Upon the identification of high-risk locations and Emphasis Areas, the next step was to identify appropriate safety countermeasures. The Caltrans LRSM provides 82 countermeasures, of which 21 are eligible in the current HSIP call for signalized intersections, 23 for un-signalized intersections, and 38 for roadway segments. The LRSM provides guidance on where to apply the countermeasures including the crash types each countermeasure would address, and a Crash Reduction Factor (CRF) for each countermeasure. The Federal Highway Administration (FHWA) CMF Clearinghouse and published research papers were reviewed by the project team to gain additional insight on CRFs and effectiveness of specific countermeasures.

The project team conducted a thorough review of the high-injury locations (intersections and roadway segments) using aerial photography, Google Maps Street View software, and in-person site visits. Crash characteristics of all collisions occurring on the High Injury Network were considered. After combining the physical and collision characteristics, the project team developed a table of preliminary countermeasures that address each of the seven identified Emphasis Areas. The table (Table 16 below) was refined by selecting up to four countermeasures for each high-risk location that were most commonly recommended among all Emphasis Areas. By doing this, the project team was able to identify countermeasures with the greatest opportunity for systemic implementation.

Countermeasure Toolbox

Engineering countermeasures were selected for each of the high-risk locations and for the emphasis areas. These were based off of approved countermeasures from the Caltrans LRSM used in HSIP grant calls for projects. The intention is to give the City potential countermeasures for each location that can be implemented either in future HSIP calls for projects, or using other funding sources, such as the City's Capital Improvement Program. Non-engineering countermeasures were also selected using the 5 E's strategies, and are included with the emphasis areas. The countermeasure toolbox in **Appendix D** details the draft countermeasures for each high-risk location and emphasis area, separated by intersections and roadway segments. While not all of these countermeasures will be included in the resulting safety projects, they are included to give the City a toolbox for implementing future safety improvements through other means, such as the City's Capital Improvement Program.

Table 16 provides a description of each countermeasure along with the CRF, federal funding eligibility, and opportunity for systemic implementation. An excerpt of the LRSM, detailing each available HSIP countermeasure referenced in the recommendations tables, is included as **Appendix D**.

Table 16. Countermeasures selected for the City of Albany

Code	Countermeasure Name	Countermeasure Description	CRF	Federal Funding	Systemic Approach Opportunity
S02	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number	Includes New LED lighting, signal back plates, retro-reflective tape outlining the back plates, or visors to increase signal visibility, larger signal heads, relocation of the signal heads, or additional signal heads.	15%	90%	Very High
S03	Improve signal timing (coordination, phases, red, yellow, or operation)	Includes adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, and coordinating signals at multiple locations.	15%	50%	Very High
S09	Install raised pavement markers and striping (Through Intersection)	Adding clear pavement markings can guide motorists through complex intersections. When drivers approach and traverse through complex intersections, drivers may be required to perform unusual or unexpected maneuvers	10%	90%	Very High
S20PB	Install advance stop bar before crosswalk (Bicycle Box)	Signalized Intersections with a marked crossing, where significant bicycle and/or pedestrians volumes are known to occur.	15%	90%	Very High
S21PB	Modify signal phasing to implement a LPI	Addition of LPI gives pedestrians the opportunity to enter an intersection 3-7 seconds before vehicles are given a green indication; only minor signal timing alteration is required.	60%	90%	Very High
NS06	Install/upgrade larger or additional stop signs or other intersection warning/ regulatory signs	Additional regulatory and warning signs at or prior to intersections will help enhance the ability of approaching drivers to perceive them	15%	90%	Very High
NS13	Install splitter-islands on the minor road approaches	The installation of a splitter island allows for the addition of a stop sign in the median to make the intersection more conspicuous.	40%	90%	Medium

Code	Countermeasure Name	Countermeasure Description	CRF	Federal Funding	Systemic Approach Opportunity
NS14	Install raised median on approaches (NS.I.)	Effective access management is key to improving safety at, and adjacent to, intersections. The number of intersection access points coupled with the speed differential between vehicles traveling along the roadway often contributes to crashes. Any access points within 250 feet upstream and downstream of an intersection are generally undesirable.	25%	90%	Medium
NS21PB	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)	Non-signalized intersections where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with turn pockets. Flashing beacons, curb extensions, advanced "stop" or "yield" markings, and other safety features should be added to complement the standard crossing elements.	35%	90%	Medium
NS22PB	Install RRFB	RRFB includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian.	35%	90%	Medium
R03	Install Median Barrier	Areas where crash history indicates drivers are unintentionally crossing the median and the crossovers are resulting in high severity crashes. The installation of median barriers can increase the number of PDO and non-severe injuries. The net result in safety from this countermeasure is connected more to reducing the severity of crashes not the number of crashes.	25%	90%	Medium
R22	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	Additional or new signage can address crashes caused by lack of driver awareness or compliance of roadway signing.	15%	90%	Very High
R27	Install delineators, reflectors and/or object markers	Installation of delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed.	15%	90%	Very High

Code	Countermeasure Name	Countermeasure Description	CRF	Federal Funding	Systemic Approach Opportunity
R28	Install edge-lines and centerlines	Any road with a history of run-off-road right, head-on, opposite-direction-sideswipe, or run-off-road-left crashes is a candidate for this treatment -install where the existing lane delineation is not sufficient to assist the motorist in understanding the existing limits of the roadway. Depending on the width of the roadway, various combinations of edge line and/or center line pavement markings may be the most appropriate.	25%	90%	Very High
R30	Install centerline rumble strips/stripes	Center Line rumble strips/stripes can be used on virtually any roadway – especially those with a history of head-on crashes.	20%	90%	High
R31	Install edge line rumble strips/stripes	Shoulder and edge line milled rumble strips/stripes should be used on roads with a history of roadway departure crashes.	15%	90%	High
R33PB	Install Separated Bike Lanes	Separated bikeways are most appropriate on streets with high volumes of bike traffic and/or high bike-vehicle collisions, presumably in an urban or suburban area. Separation types range from simple, painted buffers and flexible delineators, to more substantial separation measures including raised curbs, grade separation, bollards, planters, and parking lanes.	45%	90%	High
R36PB	Install Raised Pedestrian Crossing	Roadway segments with no controlled crossing for a significant distance in high-use midblock crossing areas and/or multilane roads locations. Flashing beacons, curb extensions, medians and pedestrian crossing islands and/or other safety features should be added to complement the standard crossing elements.	35%	90%	Medium
R37PB	Install RRFB	RRFB includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings.	35%	90%	Medium

* Code: S - Signalized intersection improvements
NS - Non-signalized intersection improvements
R - Roadway segment improvements

7 | VIABLE SAFETY PROJECTS

7 VIABLE SAFETY PROJECTS

This chapter summarizes the process of selecting safety projects as part of the analysis for Albany's LRSP. The next step after the identification of high-injury locations, emphasis areas and applicable countermeasures was to identify location specific safety improvements for all high-risk roadway segments and intersections.

Specific countermeasures and improvements were selected from the 2020 LRSM from Caltrans, where:

- S refers to improvements at signalized locations,
- NS refers to improvements at non-signalized locations, and
- R refers to improvements at roadway segments.

The corresponding number refers to the countermeasure number in the LRSM (2020). The countermeasures were grouped into safety projects for high-risk intersections and roadway segments. A total of nine safety projects were developed. All countermeasures were identified based on the technical teams' assessment of viability that consisted of extensive analysis, observations, City staff input, and stakeholder/community input. The most applicable and appropriate countermeasures as identified have been grouped together to form projects that can help make high-risk locations safer.

Table 17 lists the safety projects for high-risk intersections and roadway segments, along with total base planning level cost (2022 dollar amounts) estimates and the resultant preliminary Benefit-Cost (B/C) Ratio. The "Total Benefit" estimates were calculated for the proposed improvements being evaluated in the proactive safety analysis. This "Total Benefit" is divided by the "Total Cost per Location" estimates for the proposed improvements, giving the resultant B/C Ratio. The B/C Ratio Calculation follows the methodology as mentioned in the LRSM (2022).

Appendix F lists the detailed methodology to calculate B/C Ratio, as well as the complete cost, benefit, and B/C Ratio calculation spreadsheet.

These safety projects were chosen based on the previously completed collisions analysis, which was used to identify main collision attributes that were found to be leading factors of killed and severe collisions in Albany. These collision factors are shown below, as well as viable safety projects that can help address these factors.

Broadside Collisions: For KSI collisions in Albany, 25% of collisions were broadside collisions. This is slightly higher than its share of collisions of all severity (22%). Broadside collisions can potentially be mitigated by increasing the visibility of an intersection through updated pavement markings, new or updated signage, lighting, advance flashing beacons, and improving sight distance.

Improper Turning Collisions: For KSI collisions in the city of Albany, 13% of collisions occurred due to improper turning violation, the most of any category. It also contributed to 19% of all collisions. Countermeasures such as improving sight distance at intersections, installing dedicated left turn lanes, median splitter islands on minor road approaches, and raised medians can help to mitigate improper turning caused collisions.

Pedestrian Violations: 25% of KSI collisions in Albany involved a pedestrian, compared to just 8% of collisions of all severity. Countermeasures such as traffic calming, high visibility crosswalks, RRFBs, sidewalk bulb outs, advanced flashing warning signs, can all help to address pedestrian collisions.

Bicycle Violations: 19% of KSI collisions in Albany involved a bicycle, compared to 8% of collisions of all severity. These collisions can potentially be mitigated with enhanced bicycle infrastructure, such as protected bike lanes, bicycle boxes at signalized intersections, green paint for enhanced visibility, additional lighting, or adding bike lanes/widening shoulders.

Rear End Collisions: 26% of collisions of all severity were rear end collisions, the most of all collision types. It also makes up 6% of KSI collisions. Rear end collisions can potentially be mitigated through upgrading signal hardware or adding retroreflective borders, improving signal timing, upgrading/adding intersection warning signs, or adding flashing beacons in advance of intersections. Methods to reduce speeding, such as traffic calming, can also help to address rear end collisions.

Below is the list of identified projects for the City of Albany, with a preliminary cost estimate for each location and the resulting B/C Ratio of the project (the title of each countermeasure is located in Table 17 below):

List of Safety Projects

- Project 1: Systemic Improvements at Signalized Intersections
- Project 2: Systemic Improvements at Signalized Intersections (Pedestrian and Bicycle)
- Project 3: Systemic Improvements at Un-signalized Intersections
- Project 4: Systemic Improvements at Un-Signalized Intersections (Pedestrian Safety)
- Project 5: Citywide Signal Upgrade
- Project 6: Citywide Street Light Inventory
- Project 7: Citywide Leading Pedestrian Inventory (LPI) feasibility
- Project 8: Systemic Improvements at Roadway Segments
- Project 9: Systemic improvements at Roadway Segments (Pedestrian and Bicycle Safety)

Table 17. List of Viable Safety Projects

Location	CM1	CM2	CM3	Cost per Location	Total Cost	B/C Ratio
Project 1: Signalized Intersections: Improve signal timing, Install Raised Pavement Markers and Stripping Through Intersection						
San Pablo Ave/SR 123 at Brighton Ave	S03	S09		$9,614	**$59,465**	**74.05**
San Pablo Ave/SR 123 at Marin St	S03	S09		$11,745		
San Pablo Ave/SR 123 at Solano Ave	S03	S09		$9,962		
Marin St at Masonic Ave	S03			$8,918		
San Pablo Ave/SR 123 at Monroe St	S03	S09		$10,310		
Marin St at Santa Fe Ave	S03			$8,918		
Project 2: Signalized Intersections (Pedestrian and Bicycle safety): Improve signal hardware, Install advance stop bar before crosswalk, and Modify signal phasing to implement a Leading Pedestrian Interval (LPI)						
San Pablo Ave/SR 123 at Brighton Ave		S20PB	S21PB	$84,000	**$529,872**	**21.16**
San Pablo Ave/SR 123 at Marin St	S02			$17,920		
San Pablo Ave/SR 123 at Solano Ave	S02	S20PB	S21PB	$102,270		
Marin St at Masonic Ave	S02	S20PB	S21PB	$144,914		
San Pablo Ave/SR 123 at Monroe St	S02	S20PB	S21PB	$58,730		
Marin St at Santa Fe Ave	S02	S20PB	S21PB	$122,038		

Location	CM1	CM2	CM3	Cost per Location	Total Cost	B/C Ratio
Project 3: Unsignalized Intersection: Install larger or additional stop sign or other intersection warning/regulatory signs, Install splitter-island on the minor road approaches, and Install raised medians on approaches						
San Pablo Ave/SR-123 at Garfield Ave	NS06		NS14	$106,239	**$455,861**	**20.98**
Solano Ave at Stannage Ave	NS06	NS13	NS14	$105,770		
San Pablo Ave/SR-123 at Portland Ave	NS06	NS13	NS14	$114,646		
Solano Ave at Peralta Ave		NS13	NS14	$104,384		
Buchanan St at Madison St	NS06			$9,380		
Solano Ave at Jackson St	NS06			$15,442		
Project 4: Improvements at Unsignalized Intersection (Pedestrian and Bicycle safety): Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features) and Install RRFB						
San Pablo Ave/SR 123 at Garfield Ave	NS21PB	NS22PB		$126,224	**$886,004**	**3.57**
Solano Ave at Stannage Ave		NS22PB		$212,800		
San Pablo Ave/SR 123 at Portland Ave		NS22PB		$108,220		
Solano Ave at Peralta Ave		NS22PB		$217,820		
Solano Ave at Jackson St		NS22PB		$110,040		
Buchanan at Madison St	NS21PB			$1,400		
Key Route Blvd at Solano Ave		NS22PB		$110,040		
Project 5: Citywide Signal Upgrade						
Project 6: Citywide Street Light Inventory						
Project 7: Citywide Leading Pedestrian Inventory (LPI) feasibility						
Project 8: Roadway Segments: Install Median Barrier, Install/upgrade signs with new fluorescent sheeting, Install delineators, reflectors and/or object markers, Install edge-lines and Centerlines, Install centerline rumble strips/stripes, and Install edge line rumble strips/stripes						
Solano Ave: Cleveland Ave to City Limit (East)			R27 R31	$70,392	**$2,046,256**	**7.87**
San Pablo Ave/SR 123: City Limit (North) to 450' S of Marin Ave	R03	R22		$1,855,769		
Buchanan St: I-80 EB Ramps to San Pablo Ave		R22		$29,450		
Santa Fe Ave: 200' N of Solano Ave to City Limit (South)		R22	R27	$42,625		
Madison St: 400' N of Washington St to 450' S of Solano Ave			R28	$30,380		
Washington St: 100' W of Cerrito Ave to San Pablo Ave			R28 R30	$17,640		

Location	CM1	CM2	CM3		Cost per Location	Total Cost	B/C Ratio
Project 9: Pedestrian and Bicyclist Safety Roadway Improvements: Install Separated Bike lanes, Install raised pedestrian crossing, and Install RRFB							
San Pablo Ave/SR 123: City Limit N to 450' S of Marin Ave	R33PB	R36PB	R37PB			$716,702	**$3,513,790**	7.77
Santa Fe Ave: 200' N of Solano Ave to Solano Ave to 550' S of Marin Ave			R37PB			$298,872		
Madison St: 400' N of Washington St to 450' S of Solano Ave			R37PB			$448,728		
Solano Ave: Ramona Ave to Peralta Ave			R37PB			$699,216		
Buchanan St: I-80 EB Ramps to San Pablo Ave			R37PB			$184,072		
Marin St: Buchanan St to City Limit (East)			R37PB			$1,166,200		

Notes: CM – countermeasure. B/C ratio is the dollar amount of benefits divided by the cost of the countermeasure.

Countermeasure Name
S02- Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number
S03 - Improve signal timing (coordination, phases, red, yellow, or operation)
S09 - Install raised pavement markers and striping (Through Intersection)
S20PB - Install advance stop bar before crosswalk (Bicycle Box)
S21PB - Modify signal phasing to implement a LPI
NS06 - Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs
NS13- Install splitter-islands on the minor road approaches
NS14- Install raised median on approaches (NS.I.)
NS21PB- Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)
NS22PB- Install Rectangular Rapid Flashing Beacon (RRFB)
R03- Install Median Barrier
R22 - Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)
R27 - Install delineators, reflectors and/or object markers
R28- Install edge-lines and centerlines
R30- Install centerline rumble strips/stripes
R31- Install edgeline rumble strips/stripes
R33PB – Install separate bike lanes
R36PB- Install raised pedestrian crossing
R37PB - Install Rectangular Rapid Flashing Beacon (RRFB)

8 | IMPLEMENTATION AND EVALUATION

8 IMPLEMENTATION AND EVALUATION

This chapter describes the steps the City may take to evaluate the success of this plan and steps needed to update the plan in the future. The LRSP is a guidance document and requires periodic updates to assess its efficacy and re-evaluate potential solutions. It is recommended to update the plan every two to five years in coordination with the identified safety partners. This document was developed based on community needs, stakeholder input, and collision analysis conducted to identify priority emphasis areas throughout the City. The implementation of strategies under each emphasis area would aim to reduce KSI collisions in the coming years.

Implementation

The LRSP is a guidance document that is recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and emergency medical service-related countermeasures that can be implemented throughout the City to reduce KSI collisions. It is recommended that the City of Albany implement the selected projects in high-collision locations in coordination with other projects proposed for the City's infrastructure development in their future Capital Improvement Plans. After implementing countermeasures, the performance measures for each emphasis area should be evaluated annually. The most important measure of success of the LRSP should be reducing KSI collisions throughout the City. If the number of KSI collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

Funding is a critical component of implementing any safety project. While the HSIP program is a common source of funding for safety projects, there are numerous other funding sources that could be pursued for such projects. (See **Table 18** on the following page).

Table 18. List of Potential Funding Sources

Funding Source	Funding Agency	Amount Available	Next Estimated Call for Projects	Applicable E's	Notes
Active Transportation Program	Caltrans, California Transportation Commission, MTC	~$450 million per cycle (every two years)	2022	Engineering, Education	Can use used for most active transportation related safety projects as well as education programs? Funding available through Caltrans or MTC.
Highway Safety Improvement Program	Caltrans		May 2022	Engineering	Most common grant source for safety projects.
One Bay Area Grant (OBAG) Cycle 3	MTC (Combines various federal funds)	$750 million for 2023-2026	County & Local Program: 2022	Engineering	Distributes federal funding to cities and counties in MTC region.
Office of Traffic Safety Grants	California Office of Traffic Safety	Varies by grant	Closes January 31st annually	Education, Enforcement, Emergency Response	10 grants available to address various components of traffic safety.
Affordable Housing and Sustainable Communities Program	Strategic Growth Council and Dept. of Housing and Community Development	~$405 million	2022	Engineering, Education	Must be connected to affordable housing projects; typically focuses on bike/pedestrian infrastructure/programs.
Urban Greening	California Natural Resources Agency	$28.5 million	2022	Engineering	Focused on bike/pedestrian infrastructure and greening public spaces.
Local Streets and Road Maintenance and Rehabilitation	CTC (distributed to local agencies)	$1.5 billion statewide	N/A; distributed by formula	Engineering	Typically pays for road maintenance type projects.
RAISE Grant	USDOT	~$1 billion	2022	Engineering	Typically used for larger infrastructure projects.
Sustainable Transportation Equity Project	California Air Resources Board	~$19.5 million	TBD; most recent call in 2020	Engineering, Education	Targets projects that will increase transportation equity in disadvantaged communities.
Transformative Climate Communities	Strategic Growth Council	~$90 million	TBD; most recent call in 2020	Engineering	Funds community-led projects that achieve major reductions in greenhouse gas emissions in disadvantaged communities.

Monitoring and Evaluation

For the success of the LRSP, it is crucial to monitor and evaluate the 5 E-strategies continuously. Monitoring and evaluation help provide accountability, ensures the effectiveness of the countermeasures for each emphasis area, and help making decisions on the need for new strategies. The process would help the City make informed decisions regarding the implementation plan's progress and accordingly, update the goals and objectives of the plan.

After implementing countermeasures, the strategies should be evaluated annually as per their performance measures. The evaluation should be recorded in a before-after study to validate the effectiveness of each countermeasure as per the following observations:

- Number of KSI collisions
- Number of police citations
- Number of public comments and concerns

Evaluation should be conducted during similar time periods and durations each year. The most important measure of success of the LRSP should be reduction in KSI collisions throughout the City. If the number of KSI collisions doesn't decrease initially, then the countermeasures should be evaluated as per the other observations, as mentioned above. The effectiveness of the countermeasures should be compared to the goals for each emphasis area.

LRSP Update

The LRSP is a guidance document and is recommended to be updated every two to five years after adoption. After monitoring performance measures focused on the status and progress of the E's strategies in each emphasis area, the next LRSP update can be tailored to resolve any continuing safety problems. An annual stakeholder meeting with the safety partners is also recommended to discuss the progress for each emphasis area and oversee the implementation plan. The document should then be updated as per the latest collision data, emerging trends, and the E's strategies' progress and implementation.